

PSYCHOLOGY 305

COGNITIVE PROCESSES

Quiz

Emotion (425-434;449-452;459-464)

1. What is emotion?
2. Amygdala & fear
3. Neural substrates of other emotions (Insula & disgust)

Announcements

- Change to calendar, moved language to end of course

1. In the sentence “I went to the bank to deposit money”, which of the following gives us the ability to know that ‘bank’ is not the bank of a river?
 - a. Exemplar knowledge
 - b. Conceptual knowledge
 - c. Prototype knowledge
 - d. River knowledge

You look at a face and recognize that they have a beard. To do this, you must have knowledge of what a beard looks like. For the following examples, what type of knowledge is most likely used?

2. I recognize the beard by comparing an actual beard I've seen before to the one I'm looking at.
 - a. Definitional knowledge
 - b. Prototype knowledge
 - c. Exemplar knowledge
3. I recognize the beard by comparing an average of all beards I've seen before to the one I'm looking at.
 - a. Definitional knowledge
 - b. Prototype knowledge
 - c. Exemplar knowledge
4. I recognize the beard by knowing that beards have hair, are placed low on the face, and do not grow on the nose or lips.
 - a. Definitional knowledge
 - b. Prototype knowledge
 - c. Exemplar knowledge

5. How do we define emotion? What are the primary emotions in humans?

6. What part of the brain is involved in fear? What might happen if this area is damaged (list likely symptoms)?

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 - c. Exemplar knowledge

True love?



The image shows a screenshot of a quiz titled "Does She Really Love Me??" from Quizfarm. The quiz was created by "meeripatches". It features a "Share" button and a "Flag This Quiz" button. The quiz consists of 20 questions, each with a "No :(" and "Yes!" option followed by three radio buttons. The questions are:

1. Do y'all have a lot in common? No :(Yes!
2. Does she seem interested in you? No :(Yes!
3. Have you met her family? No :(Yes!
4. Does she cancel plans with you to be with other people? No :(Yes!
5. Does she criticize you a lot? No :(Yes!
6. Does she look at/flirt with other guys? No :(Yes!
7. Do her eyes wander when y'all are talking? No :(Yes!
8. Do you think she's cheating on you? No :(Yes!
9. Does she have to ask you to repeat yourself a lot? No :(Yes!
10. Has she tried keeping her friends and family separate from you? No :(Yes!
11. Do you know her full name? No :(Yes!
12. Has she ever cheated on you? No :(Yes!
13. Does she want you to meet her friends and family? No :(Yes!
14. Would you consider marrying her someday? No :(Yes!
15. Has she told you she loves you? No :(Yes!
16. Would she drop everything, just to be with you? No :(Yes!
17. Do you ever see fire coming out of her eyes when she looks at you? No :(Yes!
18. Has she ever told you she's too busy to see you? No :(Yes!
19. What about hinting about loving you? Has she done that? No :(Yes!
20. Does she look into your eyes when y'all are talking? No :(Yes!

Does She/He REALLY
Love Me?

True love?

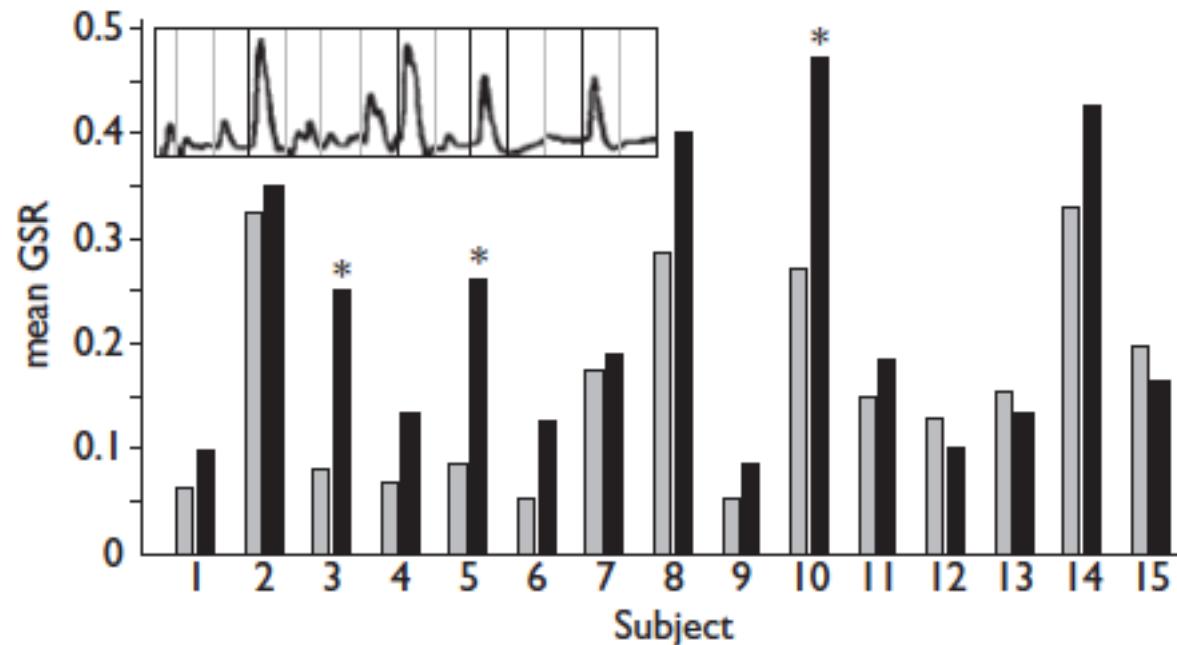
- What if she/he lies?
- Use some physiological measures
 - Heart rate
- 'True Love Tester'
 - Japanese lingerie brand “Ravijour”
 - The bra monitors the wearer's heart-rate and pops open when she 'finds true love'.

True love?

- What if she/he lies?
- Use some physiological measures
 - Heart rate
 - Galvanic skin responses (GSR)?
 - Sensitive to emotion & arousal
 - used in polygraph



15 subjects viewed pictures of their loved partner (in black) and those of their friends (in gray).

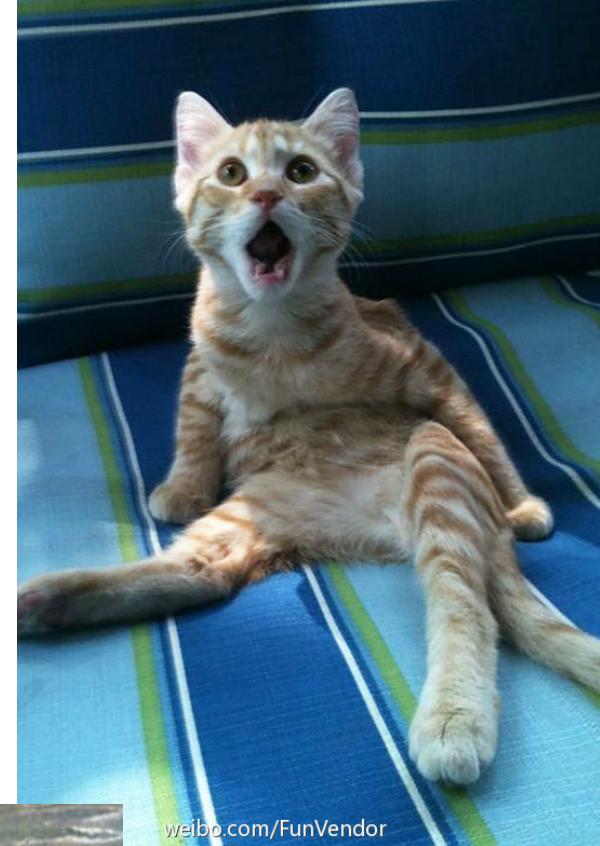
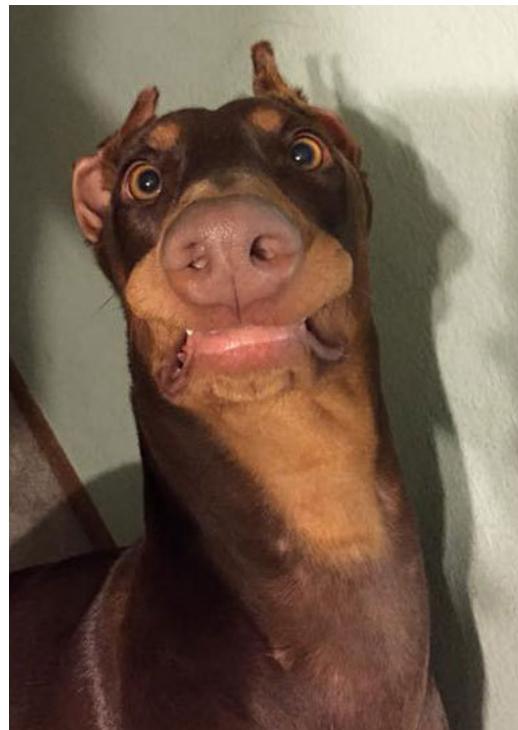


Only 3 out of 15 success rate

Bartels and Zeki, Neuroreport, 2000.

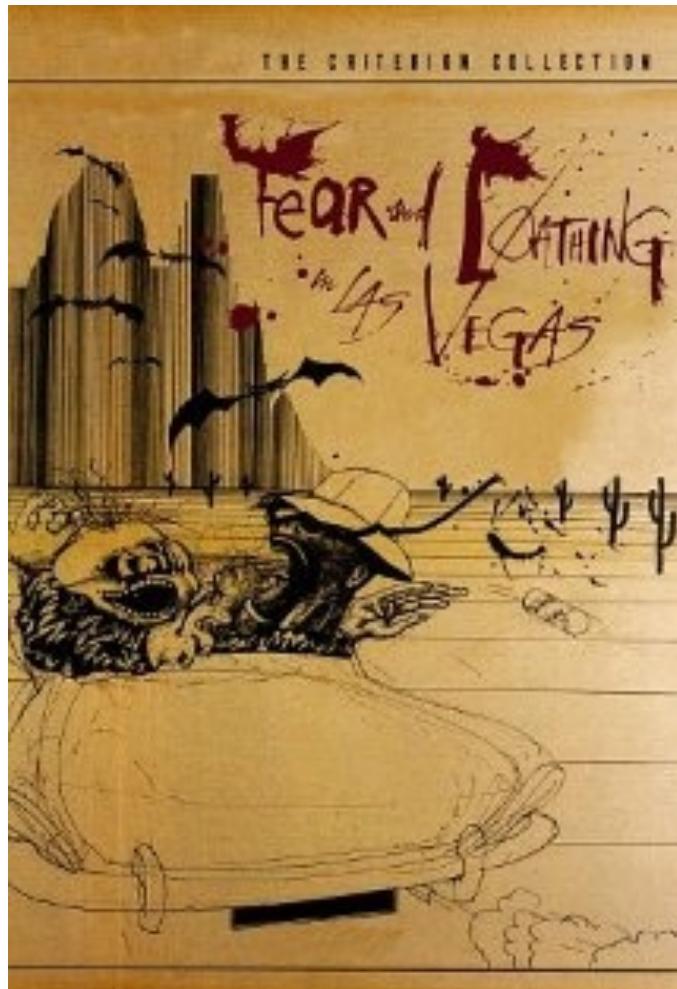
To understand

- Is emotion entirely subjective?
- Is internal emotional experience subject to scientific inquiry?
- What is emotion?



weibo.com/FunVendor

Art as the Expression of Emotion



Fear and Loathing in Las Vegas (1998)



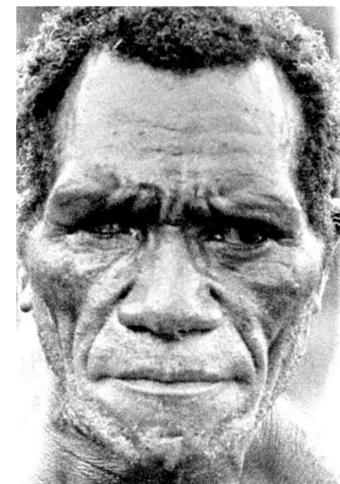
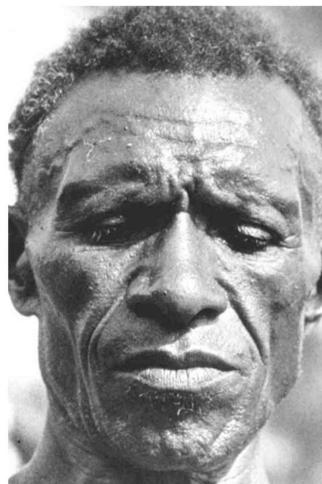
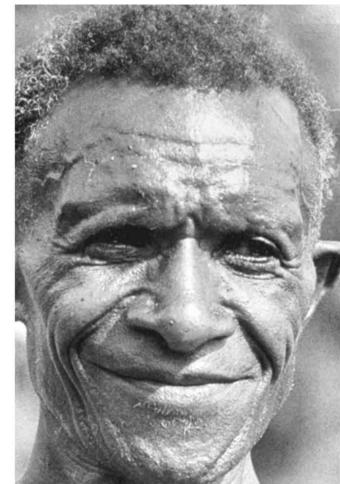
Scream, Edvard Munch, 1893
Sold for ~\$120 million in 2012

What is an emotion?

- Happy, sad, fearful, anxious, elated, disappointed, angry, pleased, disgusted, excited, guilty, gleeful, shameful, infatuated, joyful, elated, irritated, fed-up....
- How do researchers study emotions?
 - Need operational definitions of emotions.

Cross-cultural research

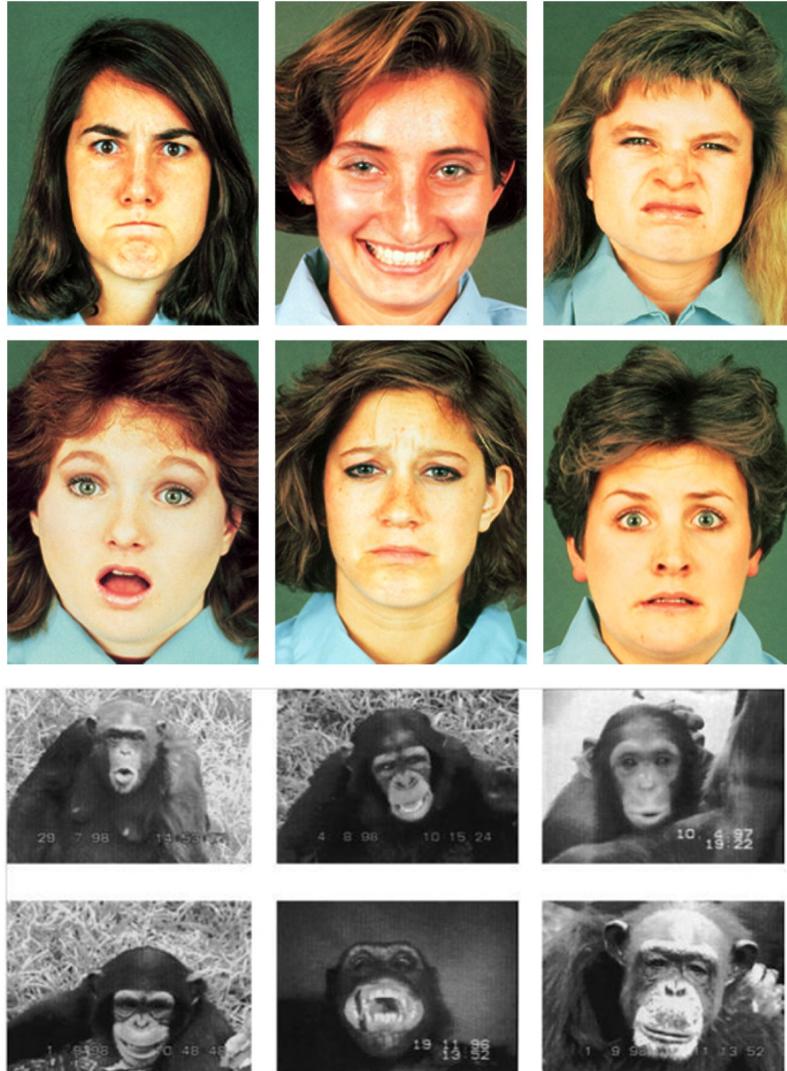
- Ekman devised a list of basic emotions from research on the Fore tribesmen of Papua New Guinea.
- Members of this isolated culture could reliably identify the expressions of emotion in photographs of people from cultures with which the Fore were not yet familiar.



Defining emotions: 2 approaches

1. Classify *basic emotions*

- Ekman: asked people to identify facial expressions:
each emotion a discrete state (Darwin hypothesis)
- Universal: appear to be true across different cultures.
- Innate
- Precursor in primates
- Further studies look for neural/physiological systems associated with each basic emotion



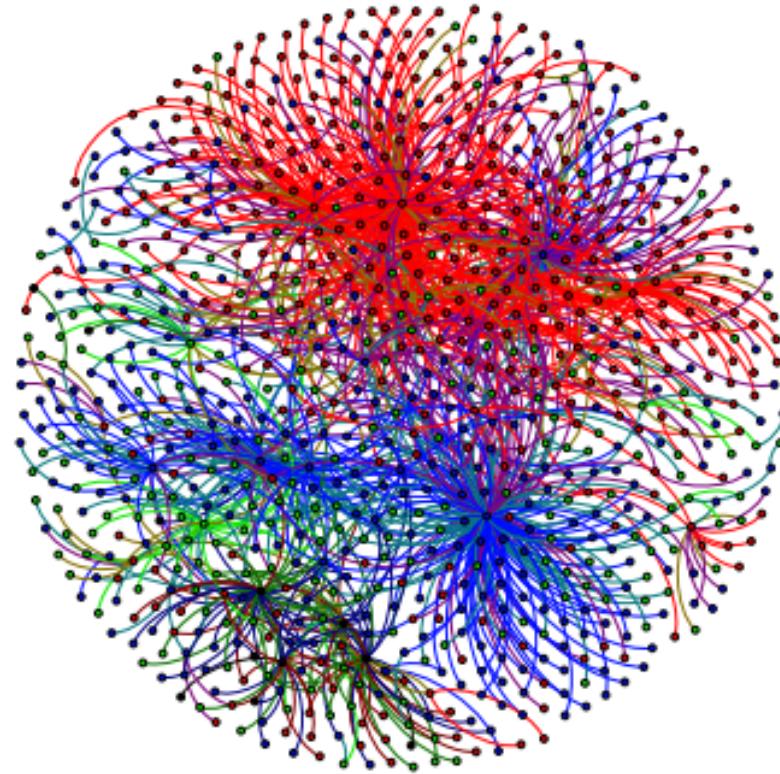
Ekman's (1972) list of basic emotions:

- Anger
- Disgust
- Fear
- Happiness
- Sadness
- Surprise



Spreads of emotion on social network

- Angry spreads quickly and broadly across a network
- Sadness and disgust do not easily spread through the network

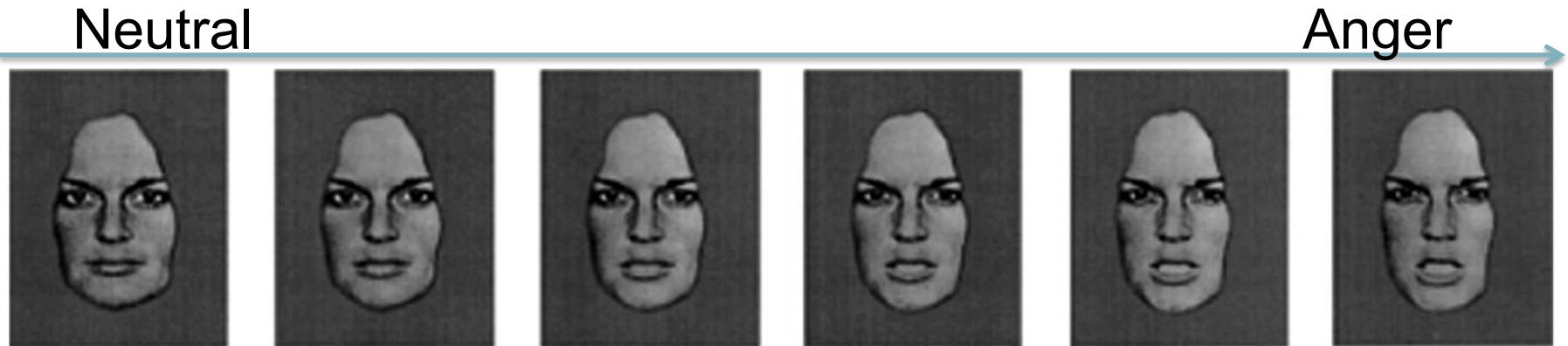


Red: anger
Green: joy
Blue: sad
Black: disgust.

Defining emotions: 2 approaches

2. Classify *dimensions of emotion*

- Describe emotions as reactions to events where each *emotion is a continuous state*
 - e.g. a little happy if you win a \$5 raffle, but a lot more happy if you win \$500,000.



Defining emotions: 2 approaches

Neutral

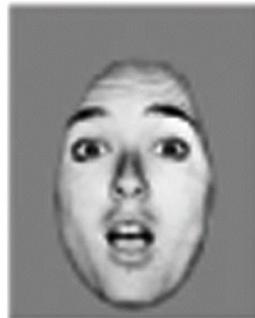
Anger



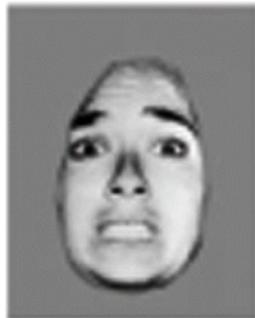
happiness



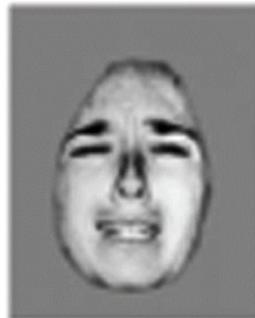
surprise



fear



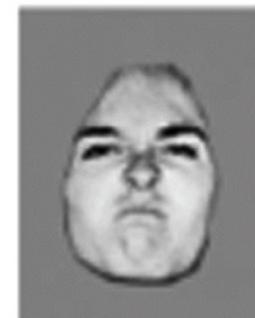
sadness



disgust



anger



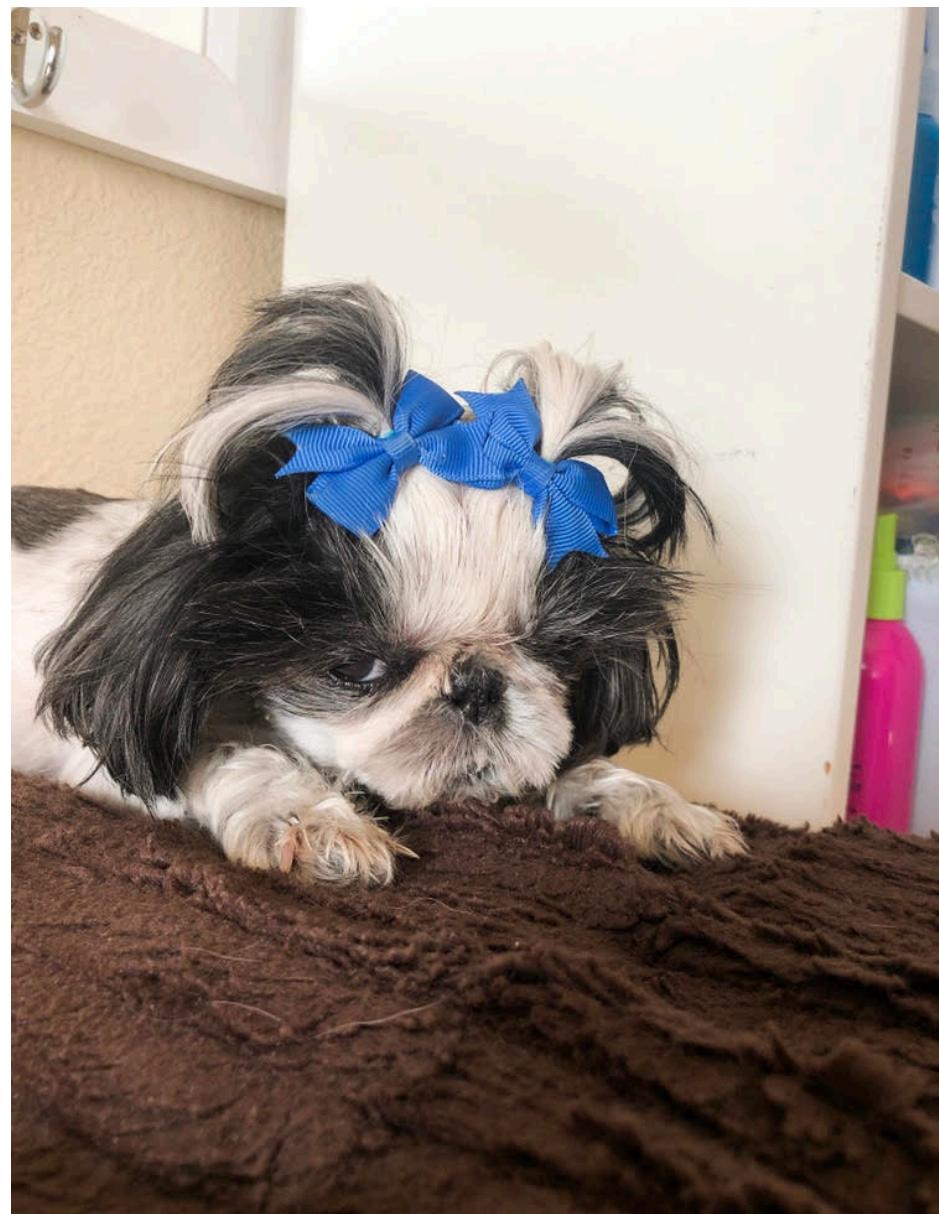
Defining emotions: 2 approaches

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- Describe emotions as reactions to events where each *emotion is a continuous state*
 - e.g. a little happy if you win a \$5 raffle, but more happy if you win \$500,000.
- 1. Characterization based on 2 continuous variables (Osgood):
 - -Valence (pleasant-unpleasant; good-bad)
 - -Arousal (intensity of the emotion; low-high)
- 2. Characterization based on actions and goals that motivate person to *approach/engage or withdraw* (Davidson)



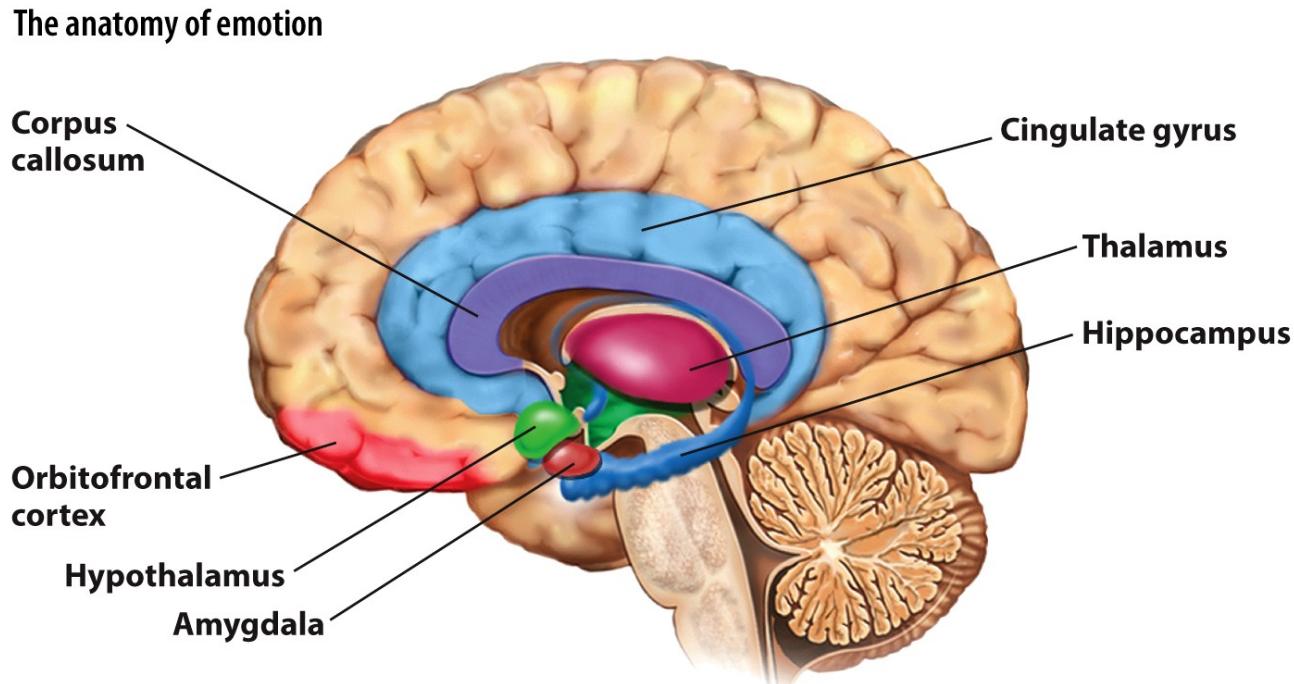
International Affective Picture System



Neural Systems of Emotional Processing

Early concept: The Limbic System

James Papez (1932) proposed a circuit of neural structures involved in emotional processing including: hypothalamus, anterior thalamus, cingulate gyrus and hippocampus

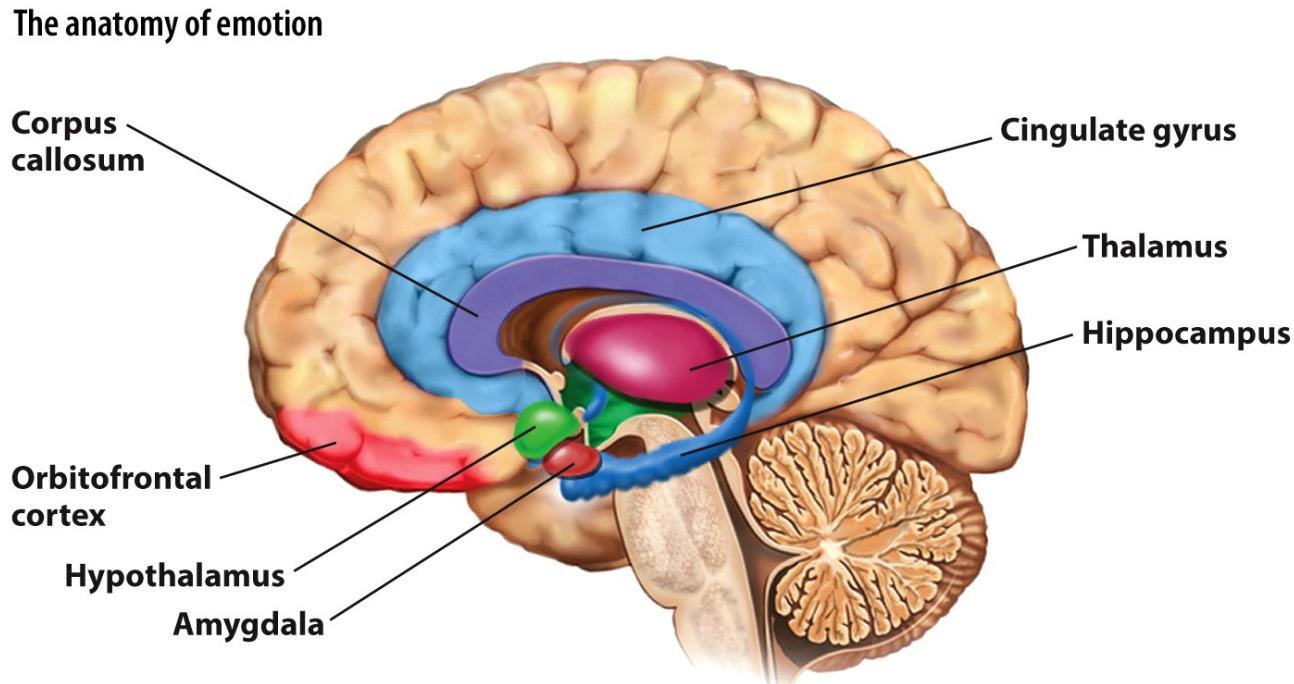


- Maclean (1949) named these structures “Papez Circuit” and extended the network of emotion to include the amygdala, orbitofrontal cortex and portions of basal ganglia.
- Extended system = “limbic system”(Maclean, 1952)
 - “limbic” from the Latin *limbus*, for “border” or “edge”

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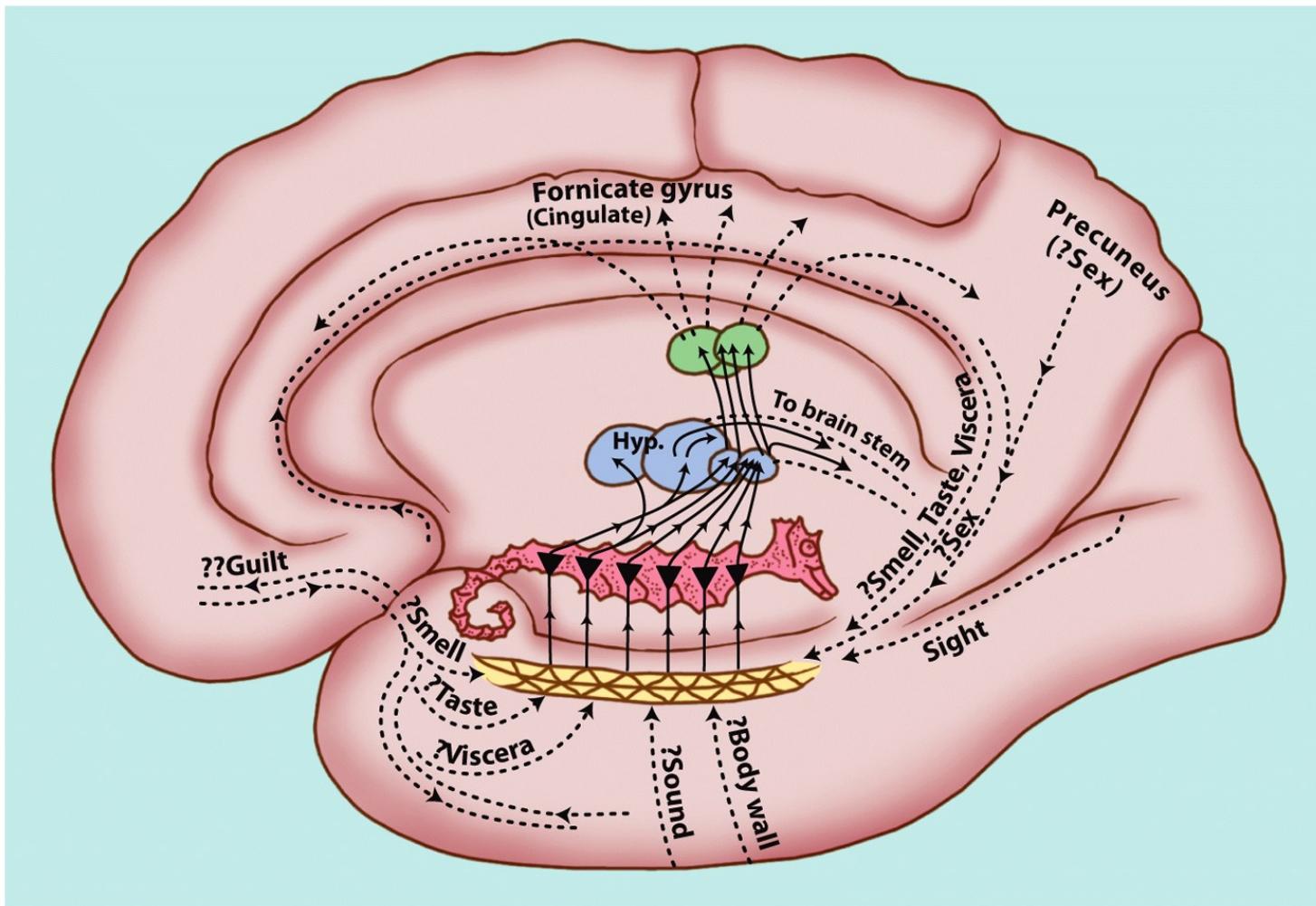


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Problems w “Limbic system” concept

- Unclear why some structures are “limbic” and not others
- Some limbic regions known to be more important for non-emotional, cognitive behaviors (e.g., hippocampus)
 - Some key players: amygdala, orbital frontal, anterior cingulate, insula, hippocampus (not directly involved in emotion).
- Emotions are not processed in their own circuit but include interactions between many circuits (e.g. memory, attention, decision-making, etc.)
- Studies now focus more on types of emotional tasks and identifying neural systems underlying emotional behaviors.
 - Involve networks of areas

Papez circuit: Not that simple

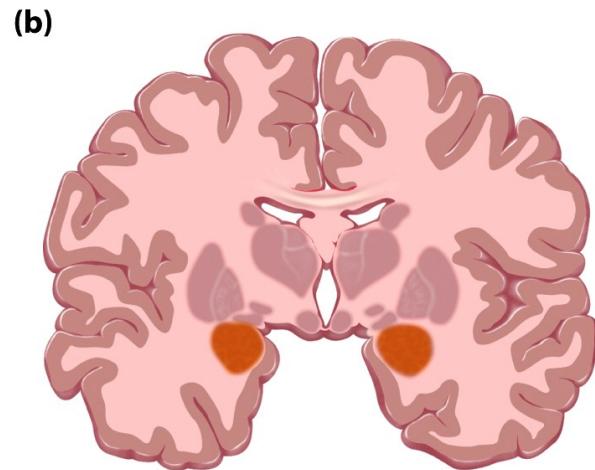
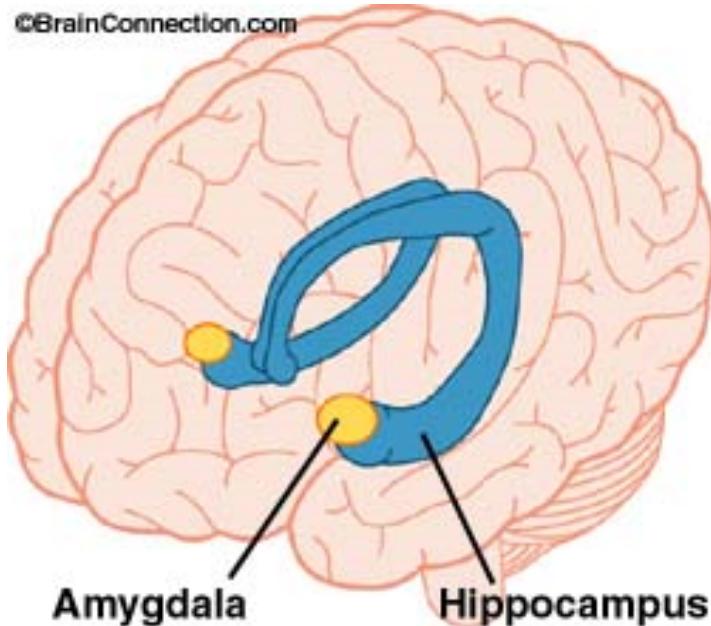


- McLean and Papez suggest that circuit supports emotion.

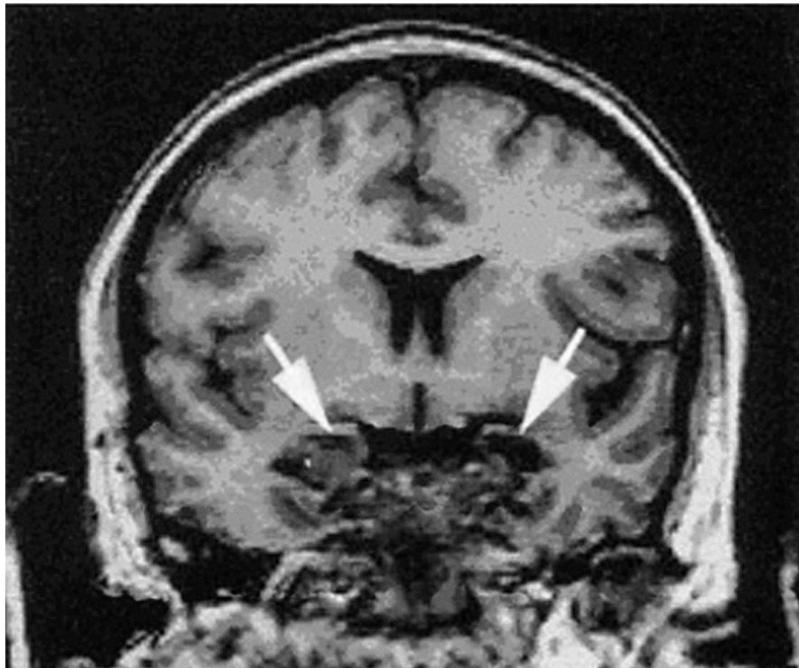
Papez circuit: Not that simple

- Papez circuit: we now know many more brain regions involved in emotion (orbital frontal, prefrontal). Also, some of those regions (hippocampus) do more than emotion.
- Some key players: amygdala, orbital frontal, anterior cingulate, insula, hippocampus (not directly involved in emotion).

Fear: the amygdala

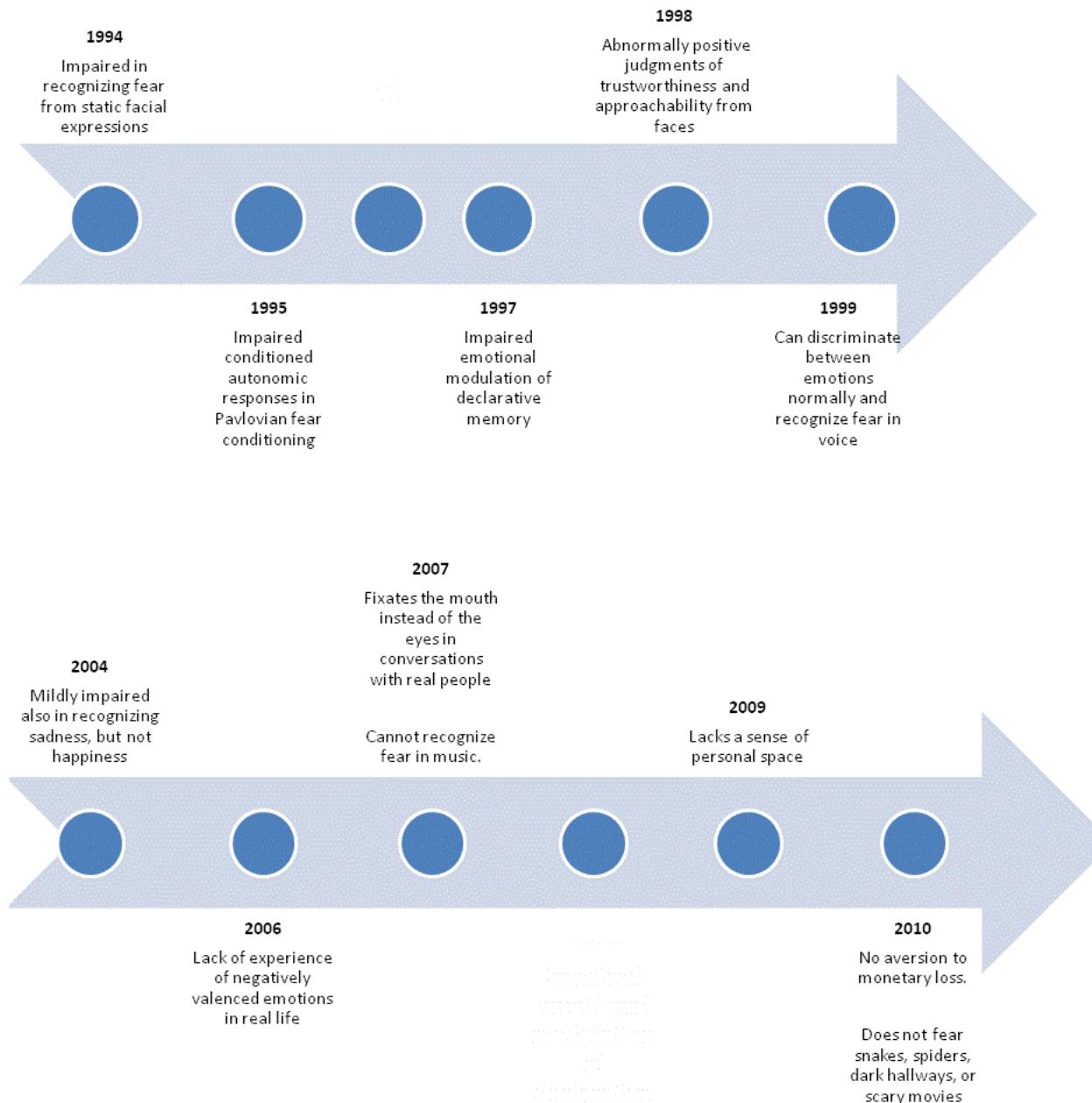


Woman who does not fear

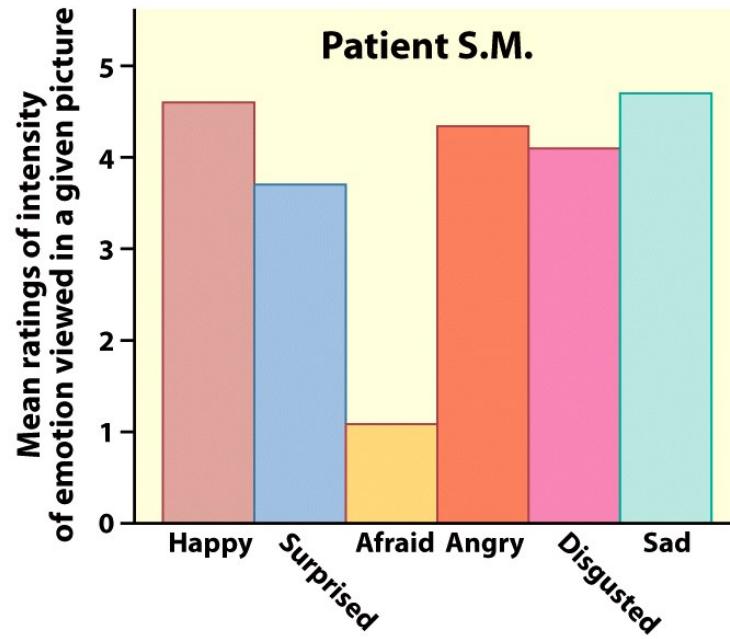
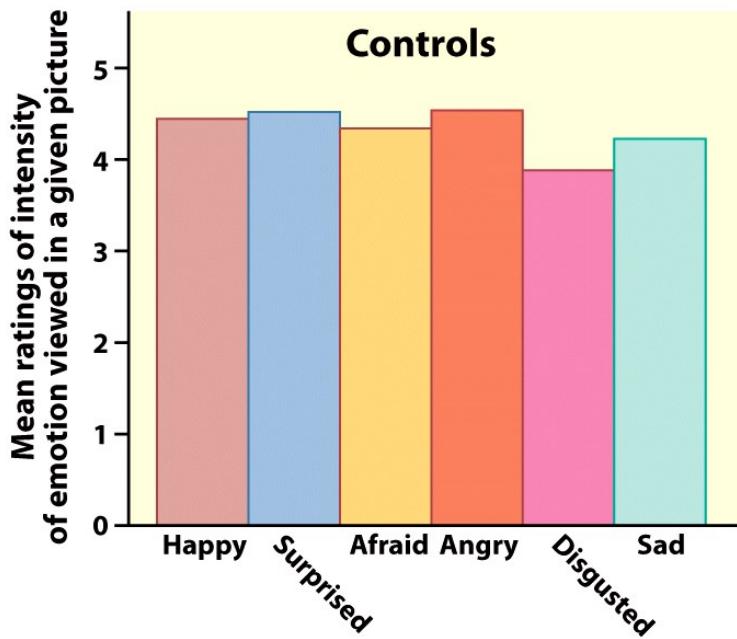


- S.M. 38 yrs old (in 2005)
- A rare genetic disorder: Urbach-Wiethe disease
- lesion of all nuclei of amygdala bilaterally; most all other subcortical structures intact.
- Normal perception, memory, language, reasoning

The Story of S.M.



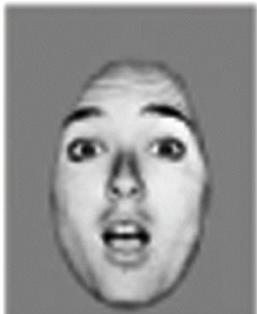
SM: deficit in identifying fearful expressions



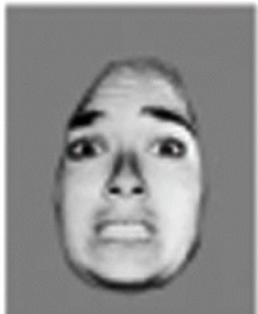
happiness



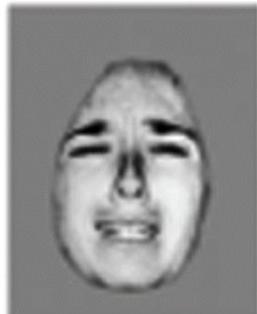
surprise



fear



sadness



disgust



anger



SM: deficit in generating fearful expressions



Happy



Sad



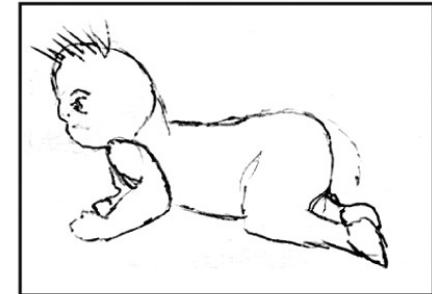
Angry



Surprised



Disgusted



Afraid

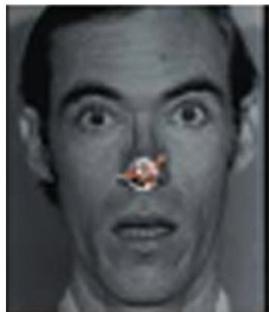
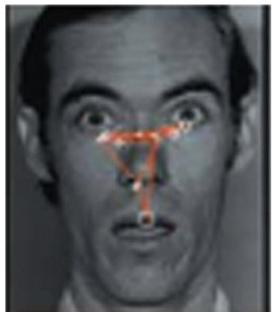
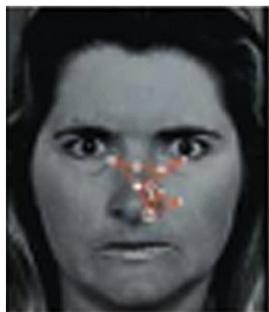
Adolphs et. al. (1995) Fear and the Human Amygdala. *The Journal of Neuroscience*, 15(9): 5878–5891. © Society for Neuroscience.

- Note most impaired when asked to draw fear.
- Why?

Control



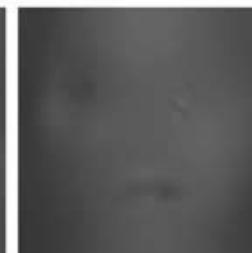
SM



Controls



S.M.



Controls - SM

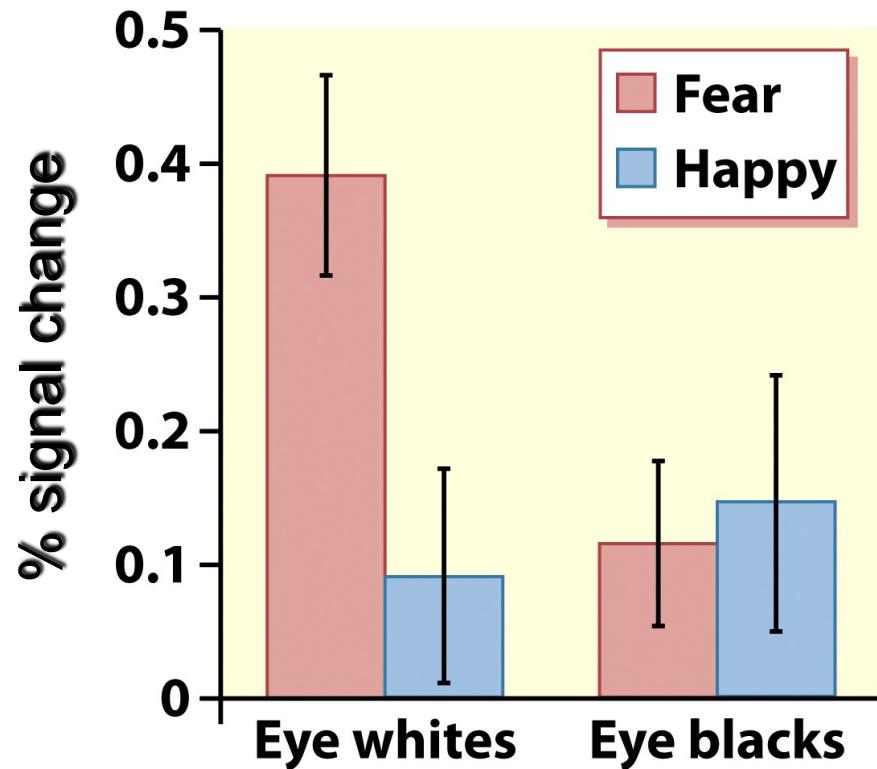
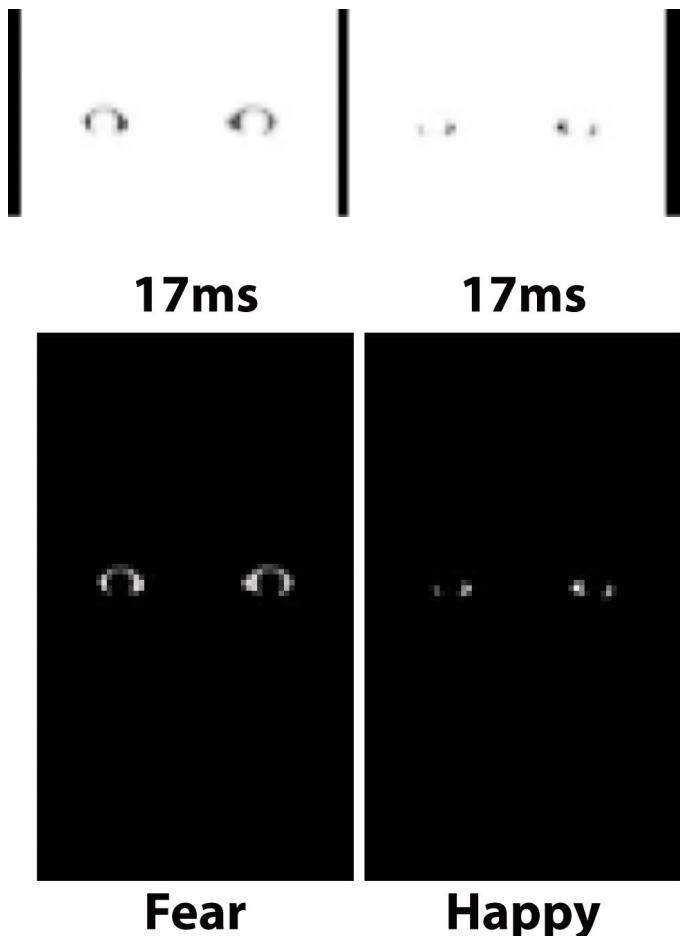


Fearful

Happy

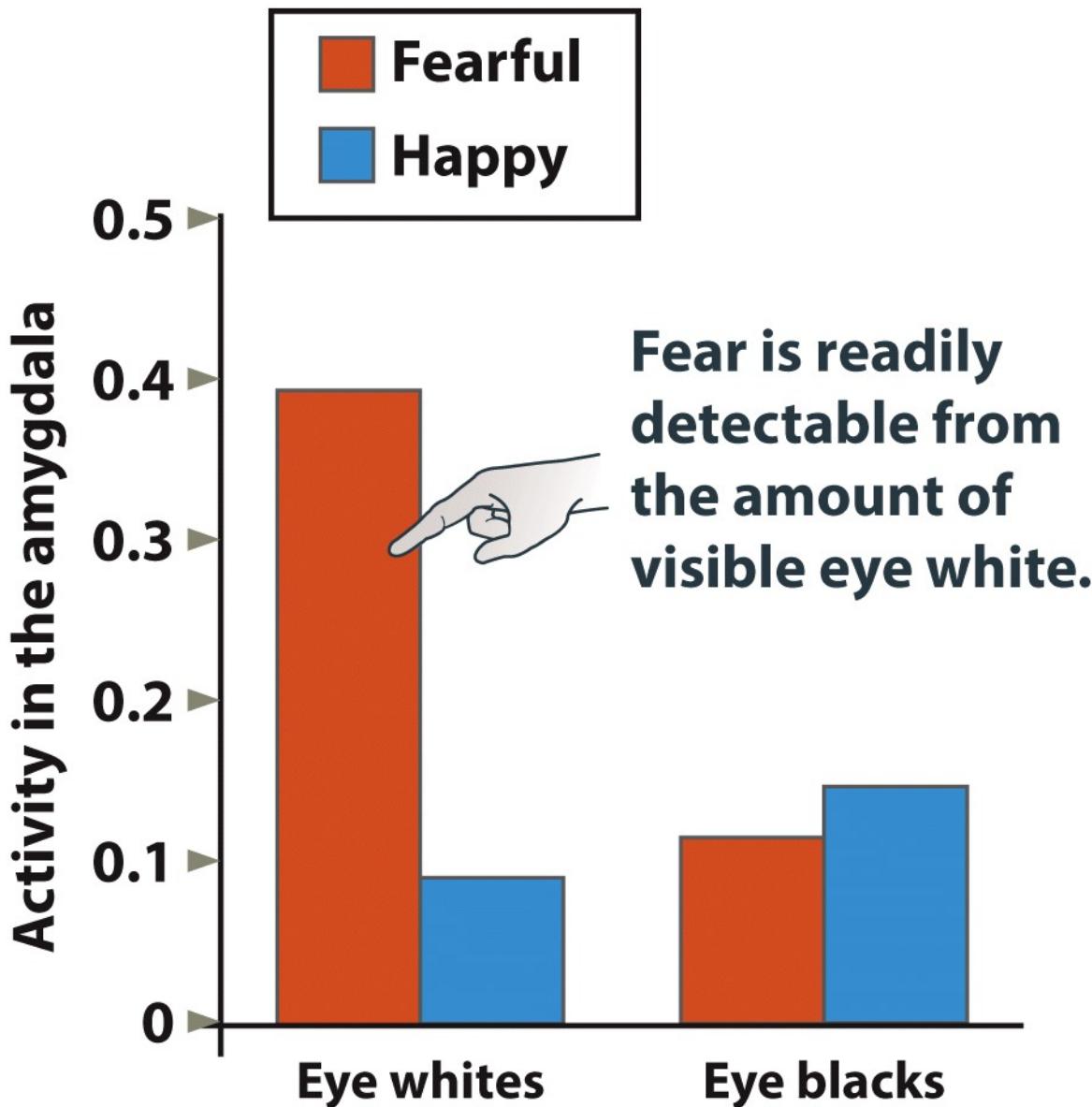
- SM does not use information from the eyes for any emotion.
- Impairs identification of fear, sadness the most (contrast with happiness, which can be inferred by the mouth).

Amygdala shows increased activation for larger eyes during fear expression

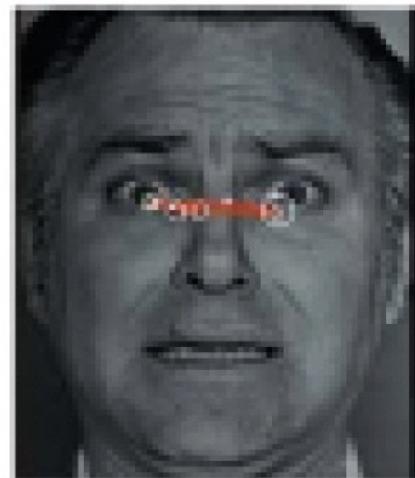
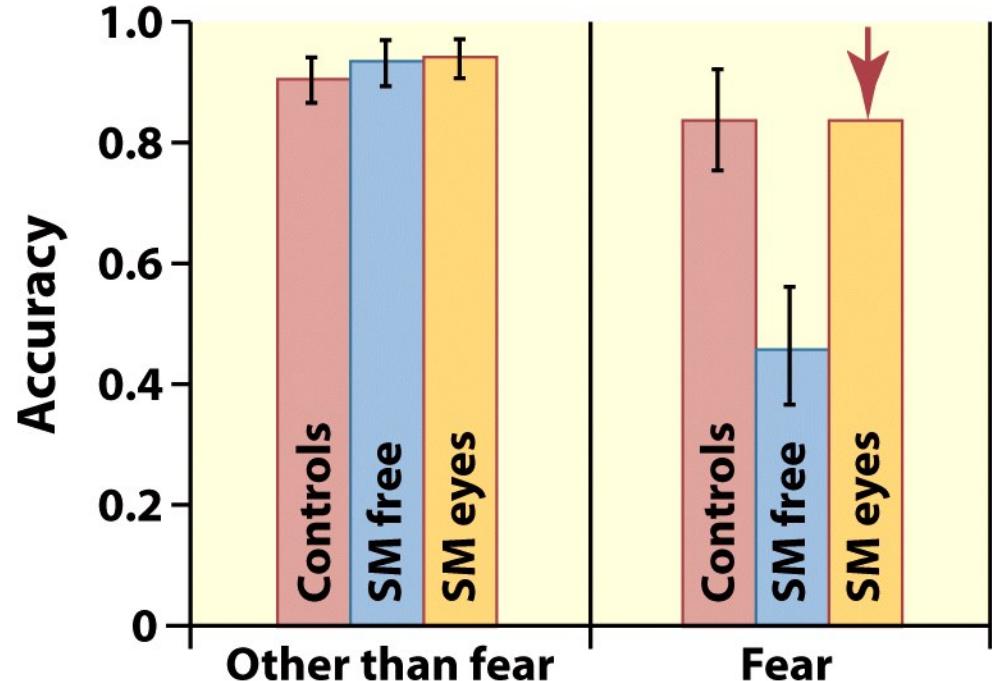


- Eye blacks are opposite pattern of color, white areas become black and black areas become white.
- Shows that larger white area of eyes are key to response.

Size of eye whites alone is sufficient to induce differential amygdala response to fearful expressions

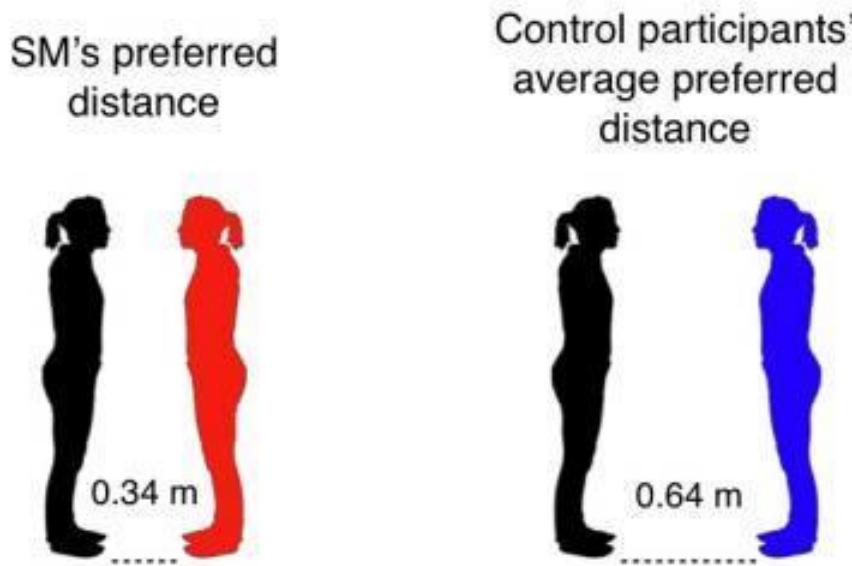


- Identification of fearful expression improves when instructed to look at the eyes.



SM and social interactions

- Difficulty judging trustworthiness of others
 - Personal space



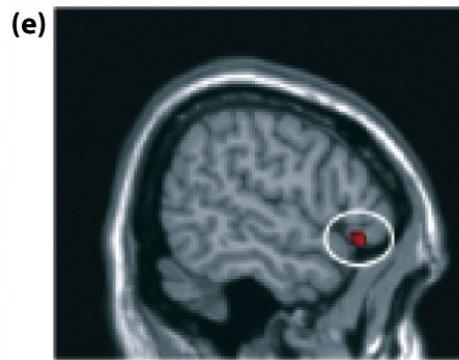
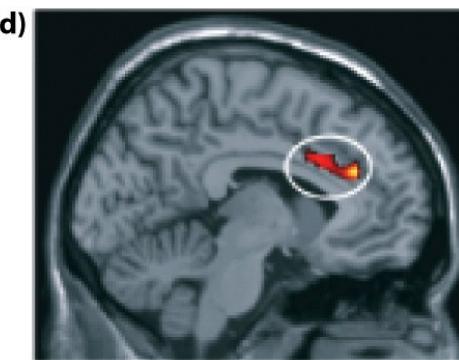
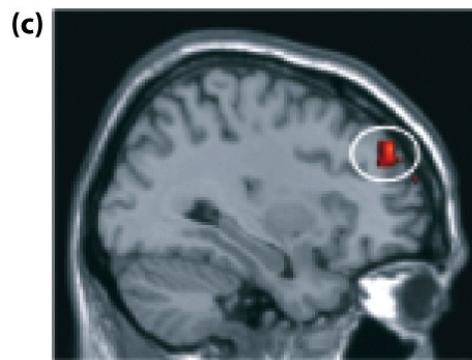
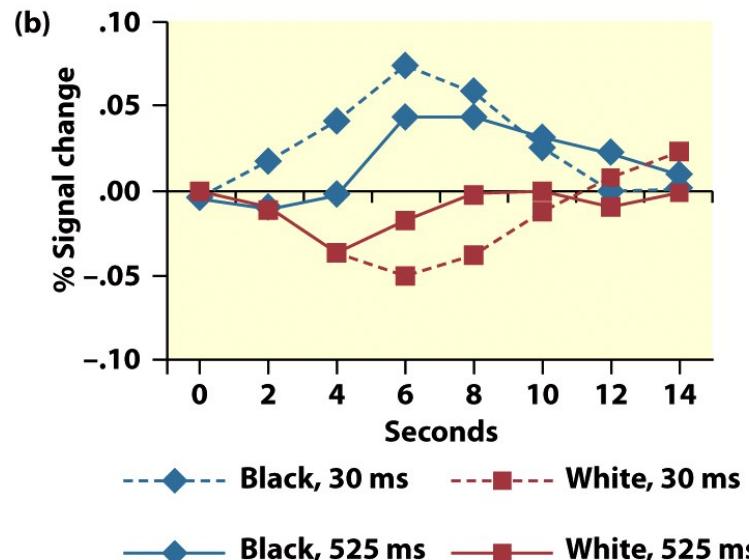
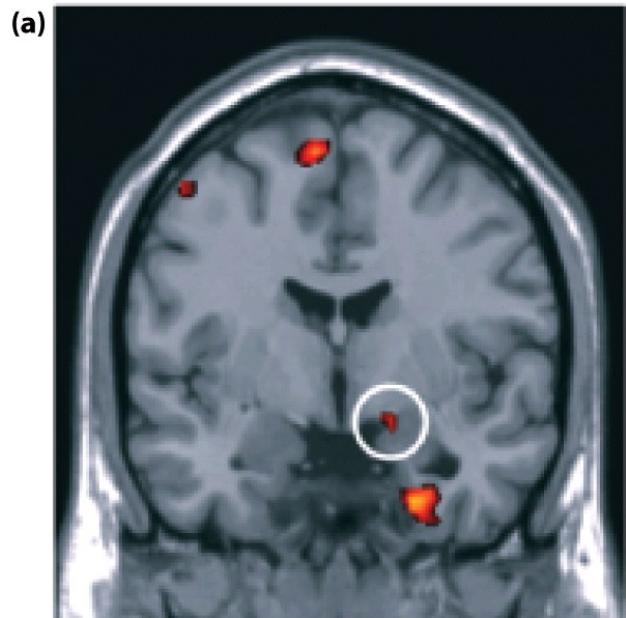
- Social behavior
 - Overly trusting
 - Overly friendly

*Nature Neuroscience, 2009; DOI: 10.1038/nn.2381
Personal space regulation by the human amygdala.
Daniel P Kennedy¹, Jan Gläscher¹, J Michael Tyszka² & Ralph Adolphs^{1,2}*

Amygdala and Implicit Fear

- Amygdala also activated for implicit social fear (e.g., white people to unfamiliar black faces) etc.

Neural correlates of racism?



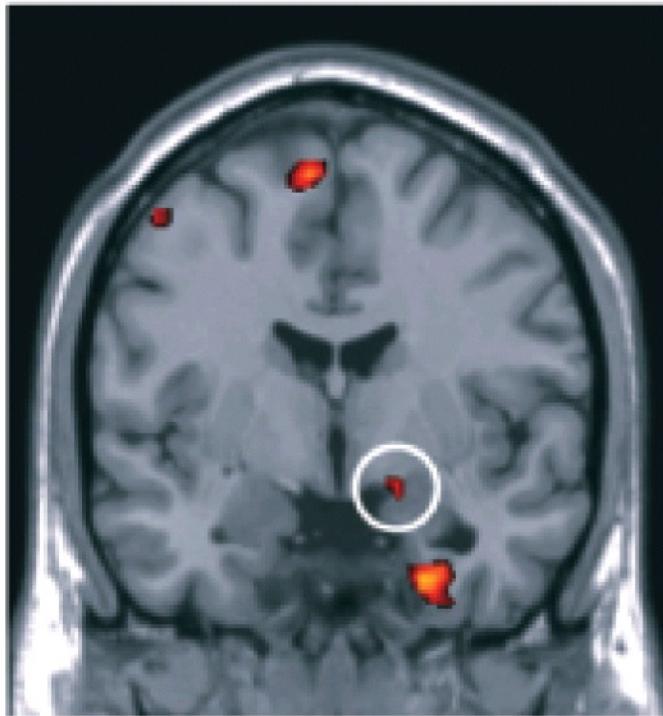
- Activation is stronger in whites for black faces shown subthreshold (masked 30 msec) in amygdala. Longer presentation of black faces results in prefrontal cortex activation and less amygdala activation.
- White faces show little of either.

Phelps et al/ (2000)

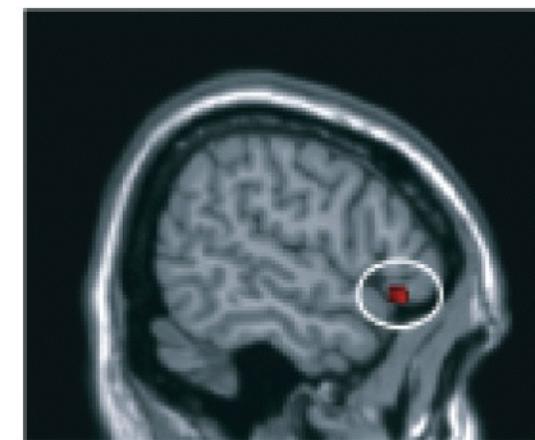
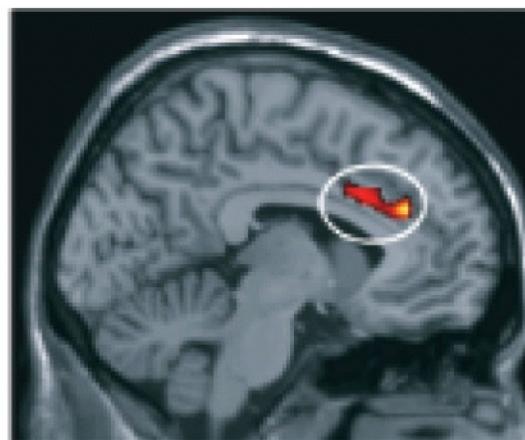
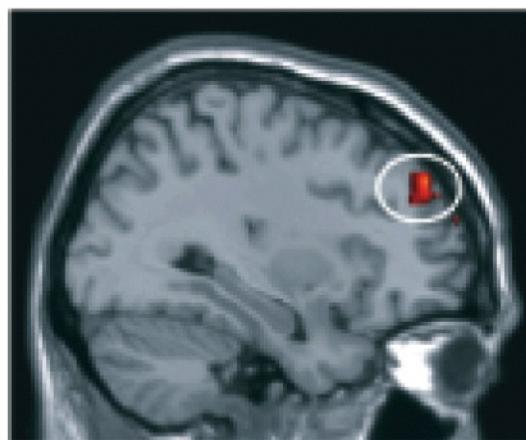
Can you think of other reasons why there might have been differences in activation?

- Authors did not test *black people* viewing white and black faces.
- Could be that we are aware but not necessarily reactive to faces (i.e., reverse inference problem).
- Category queues may overcome racial identification (e.g., if both whites and blacks are wearing red compared to another group of whites and blacks wearing blue).

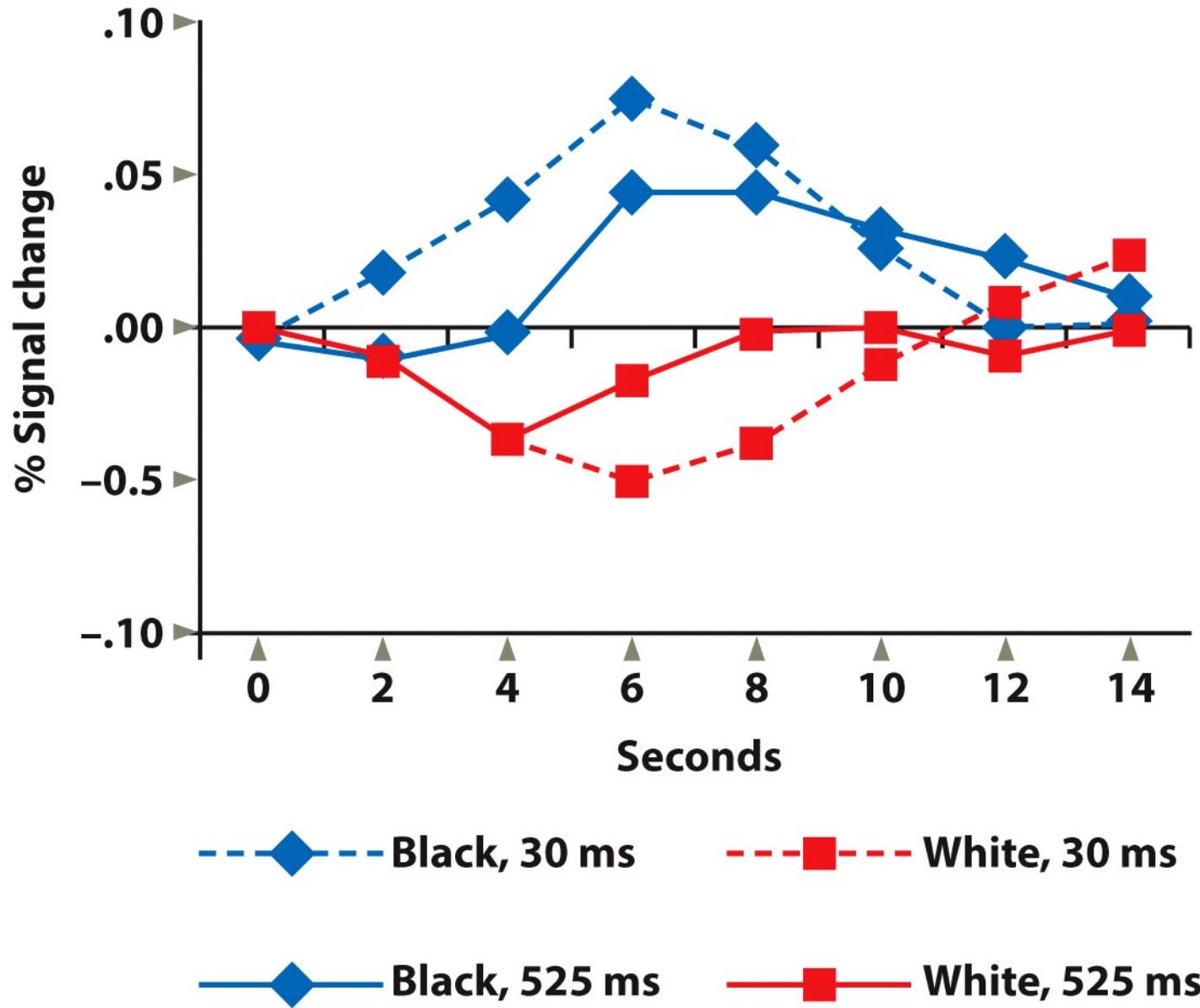
Differential neural response in white participants to masked and unmasked black and white faces



Cunningham et al. (2004). Separable neural components in the processing of Black and White Faces. *Psychological Science*, 15: 806–813. © 2004, Association for Psychological Science.



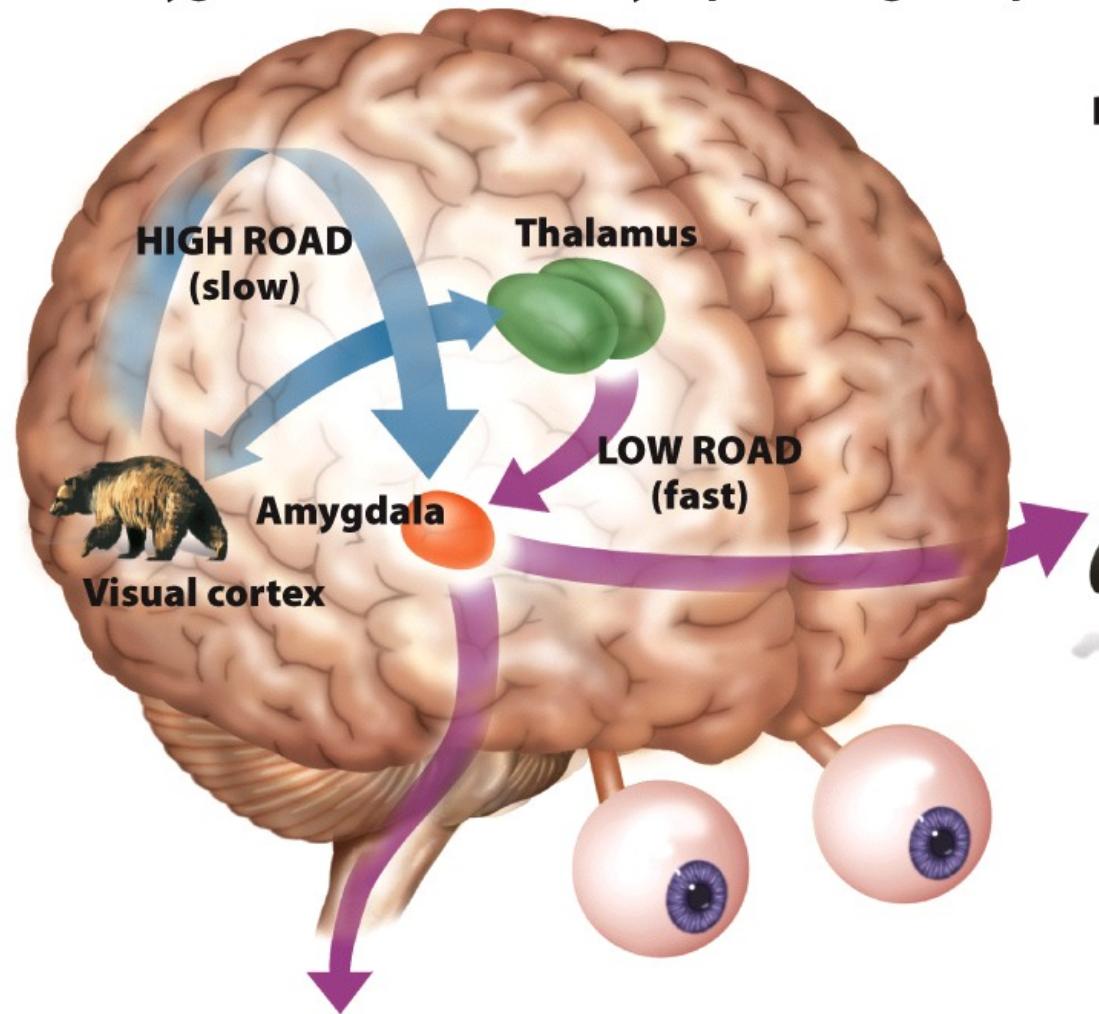
Differential neural response in white participants to masked and unmasked black and white faces



Amygdala: multiple pathways

Information can reach amygdala through fast (but coarser) thalamic route as well as slower (more detailed) cortical route.

May be related to implicit and explicit emotional learning.



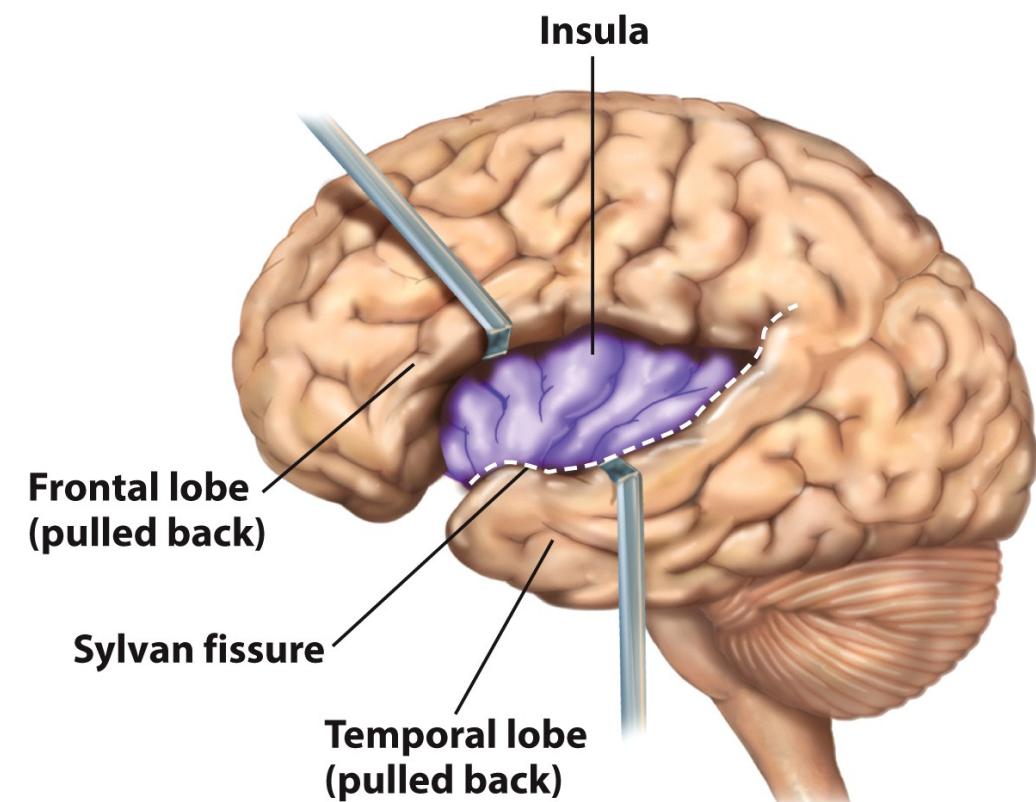
Loathing: Insula cortex

Part of “Limbic system”.

Between parietal and temporal lobes.

Involved in emotional processing.

Plays role in mapping bodily (visceral) states with emotional experiences.



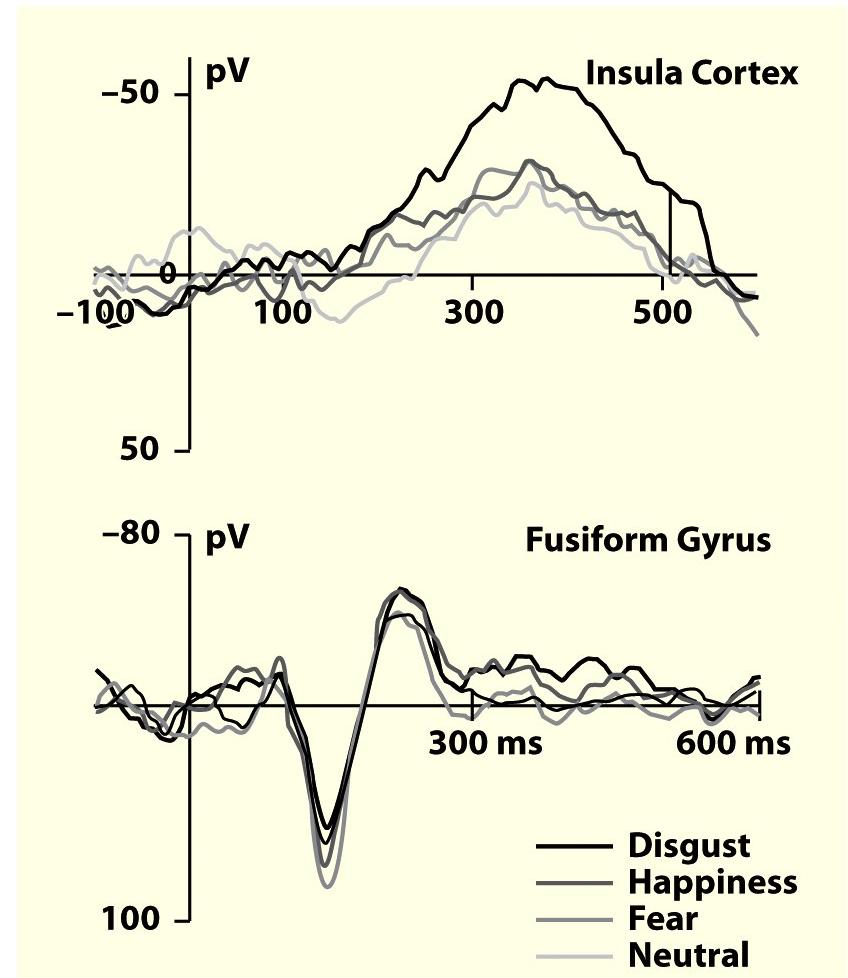
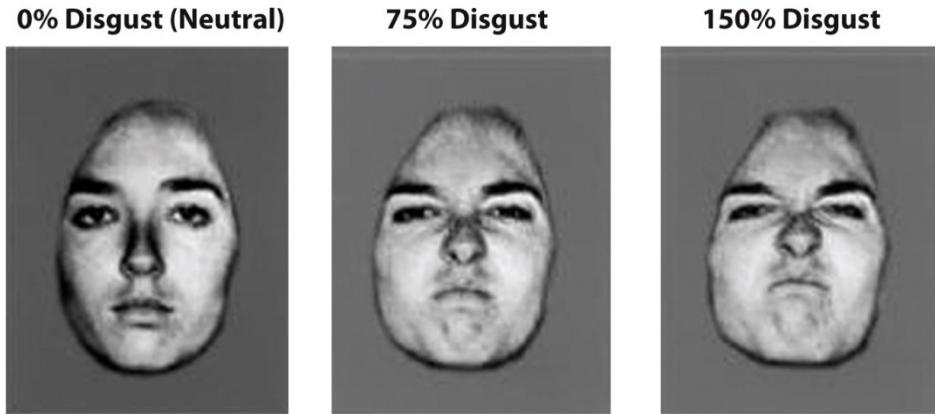
Disgust and decision making

- Somatic marker hypothesis (Damasio): Emotional information from physiological arousal is needed to guide decision making, “gut feeling”
 - We are not usually “rational decision makers” (cost-benefit analysis takes too long), rather we rely on hunches, gut or instinct (pleasant-unpleasant) to make quick decisions.
 - This “gut” feeling is related to our bodily states

Insula & Disgust: fMRI

Feeling disgust from seeing pictures of rotten food, rotten smells, poor hygiene activates insula

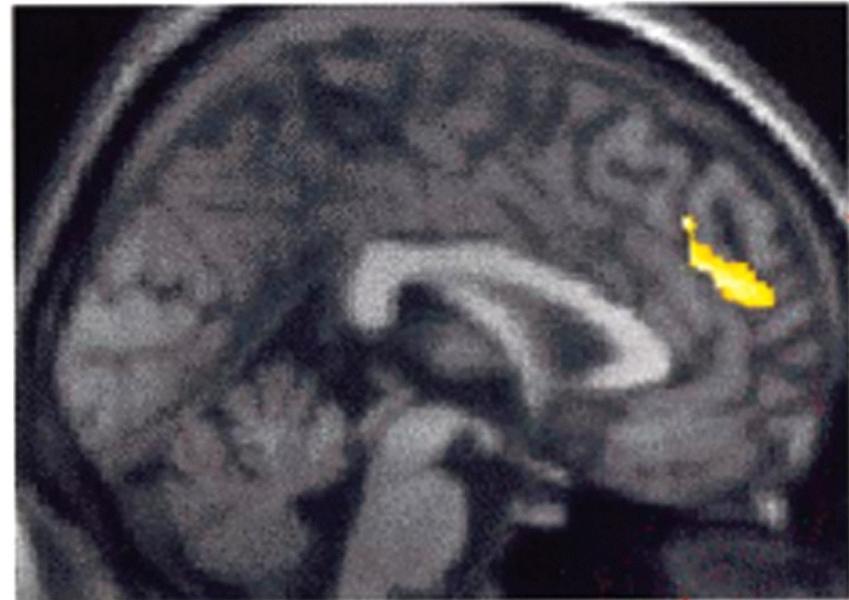
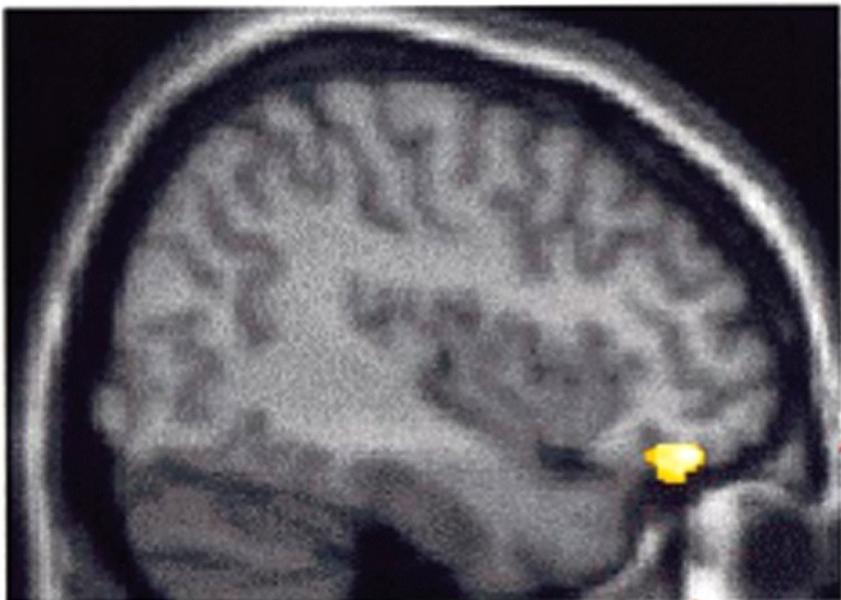
Seeing a face that is experiencing disgust:



Krolak-Salmon et al. (2003)

Phillips et al. (1997) Nature

Neural correlates of anger



R.J.R. Blair et. al. Dissociable neural responses to facial expressions of sadness and anger, *Brain*. 1999, 122, 883–893, by permission of Oxford University Press.

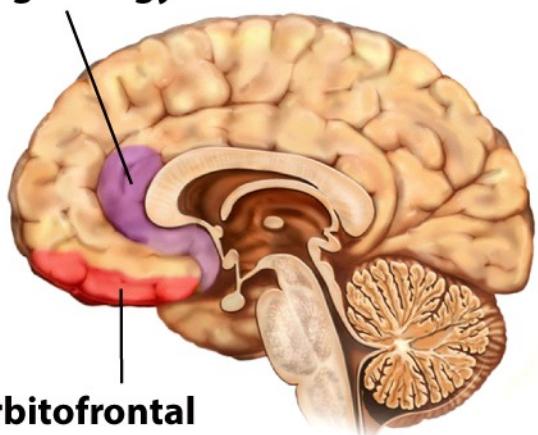
Activity in the (a) right orbitofrontal cortex and (b) anterior cingulate increased as the intensity of an angry facial expression increased.

Specific brain regions for specific emotions

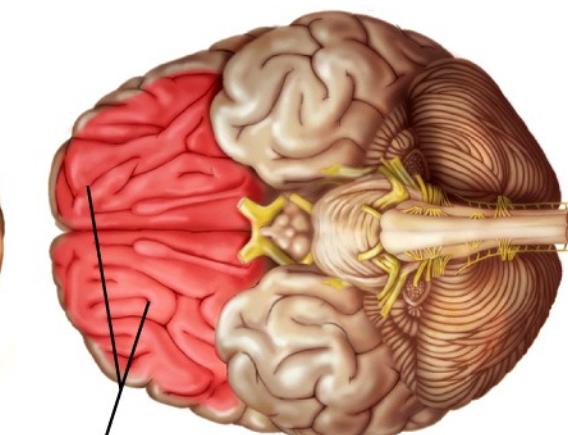
Disgust



Anterior cingulate gyrus
Orbitofrontal cortex

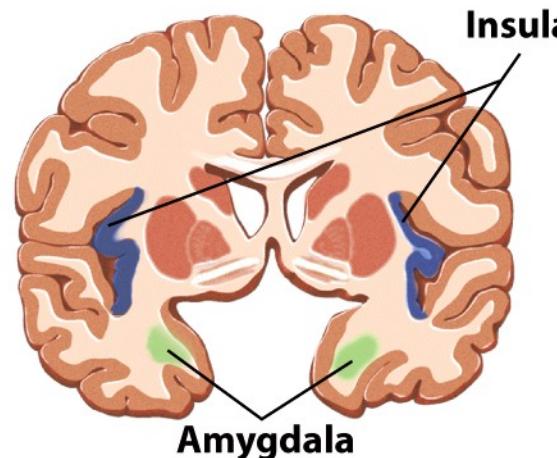


Orbitofrontal cortex

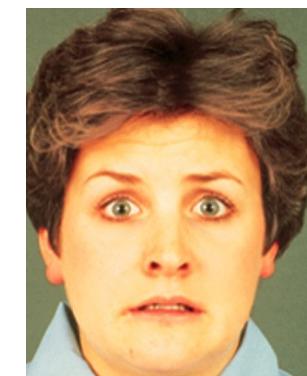


Orbitofrontal cortex

Insula



Amygdala



Anger



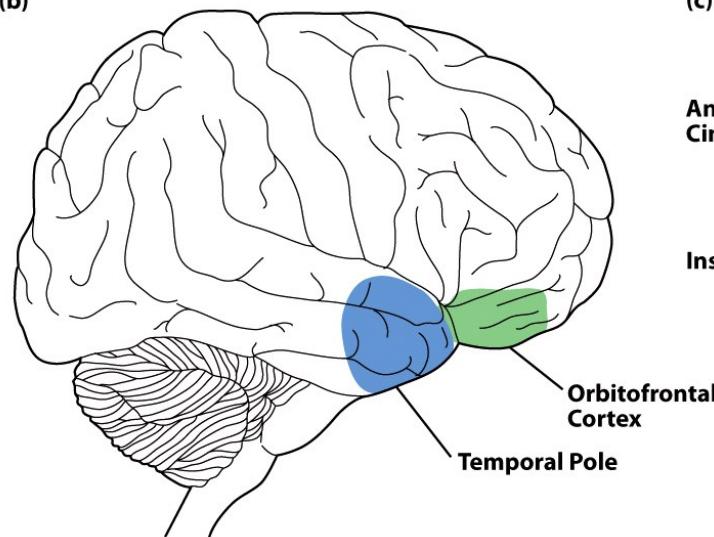
Fear

Other brain regions involved in emotion processing

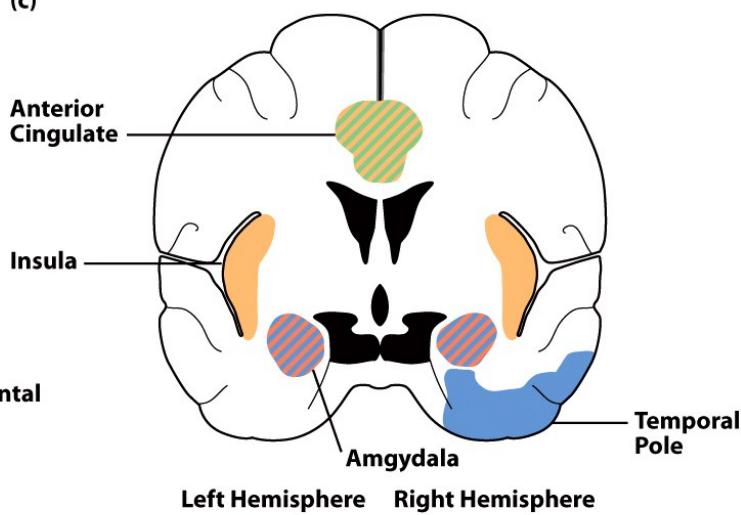
(a)

Emotion	Associated Brain Area	Functional Role
Fear	Amygdala	Learning, Avoidance
Anger	Orbitofrontal Cortex, Anterior Cingulate Cortex	Indicate Social Violations
Sadness	Amygdala, Right Temporal Pole	Withdraw
Disgust	Anterior Insula, Anterior Cingulate Cortex	Avoidance

(b)



(c)

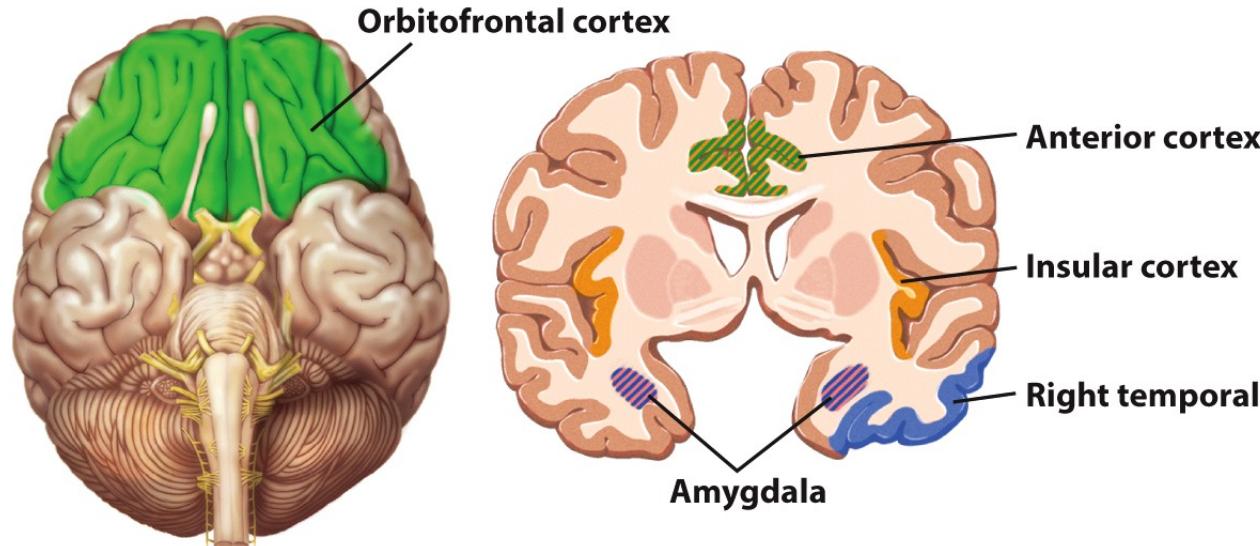


- Oversimplifications but helpful as a general rule.

Other brain regions involved in emotion processing

Brain areas associated with various emotions

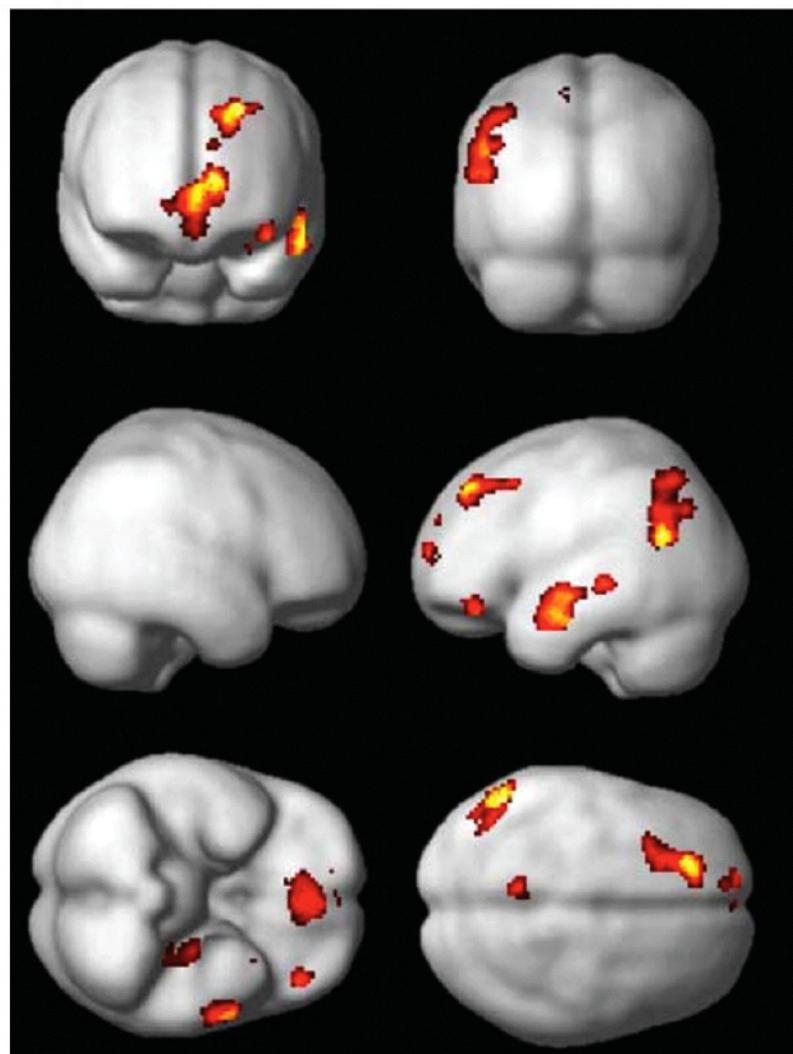
Emotion	Associated brain area	Functional role
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Disgust	Anterior insula, anterior cingulate cortex	Avoidance



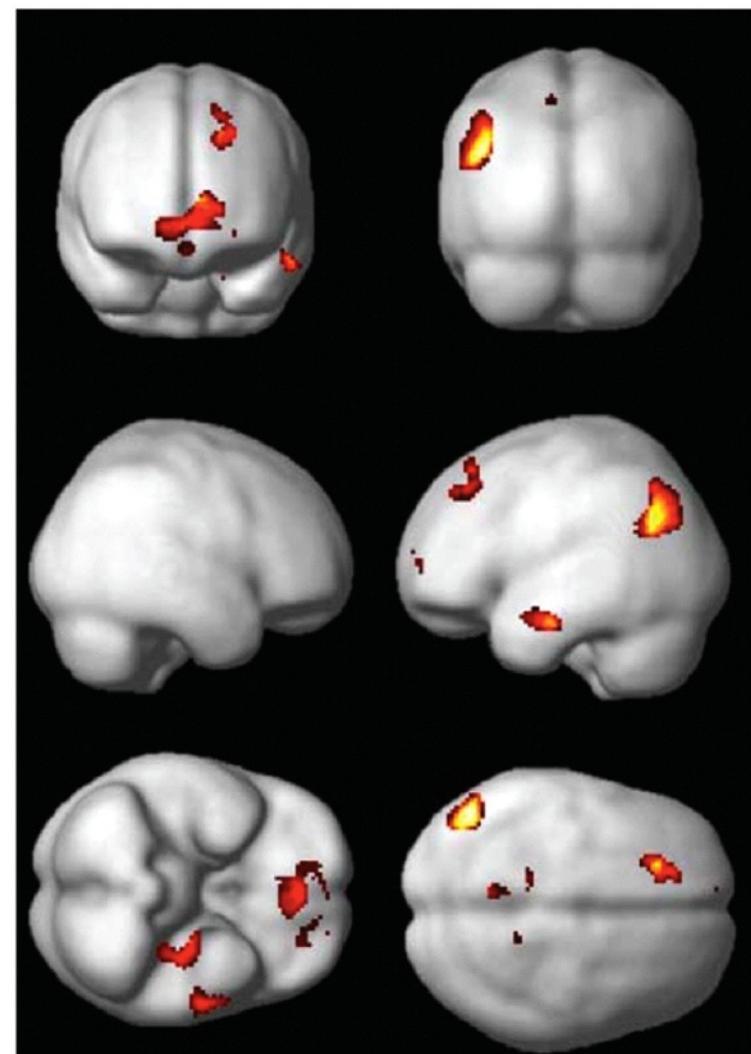
- Oversimplifications but helpful as a general rule.

Common and different brain regions are activated with sadness and happiness

Habel et al. May 2005. Same or different? Neural correlates of happy and sad mood in healthy males. *NeuroImage*, 26(1): 206–214. © 2005 Elsevier.



Sadness-Cognition

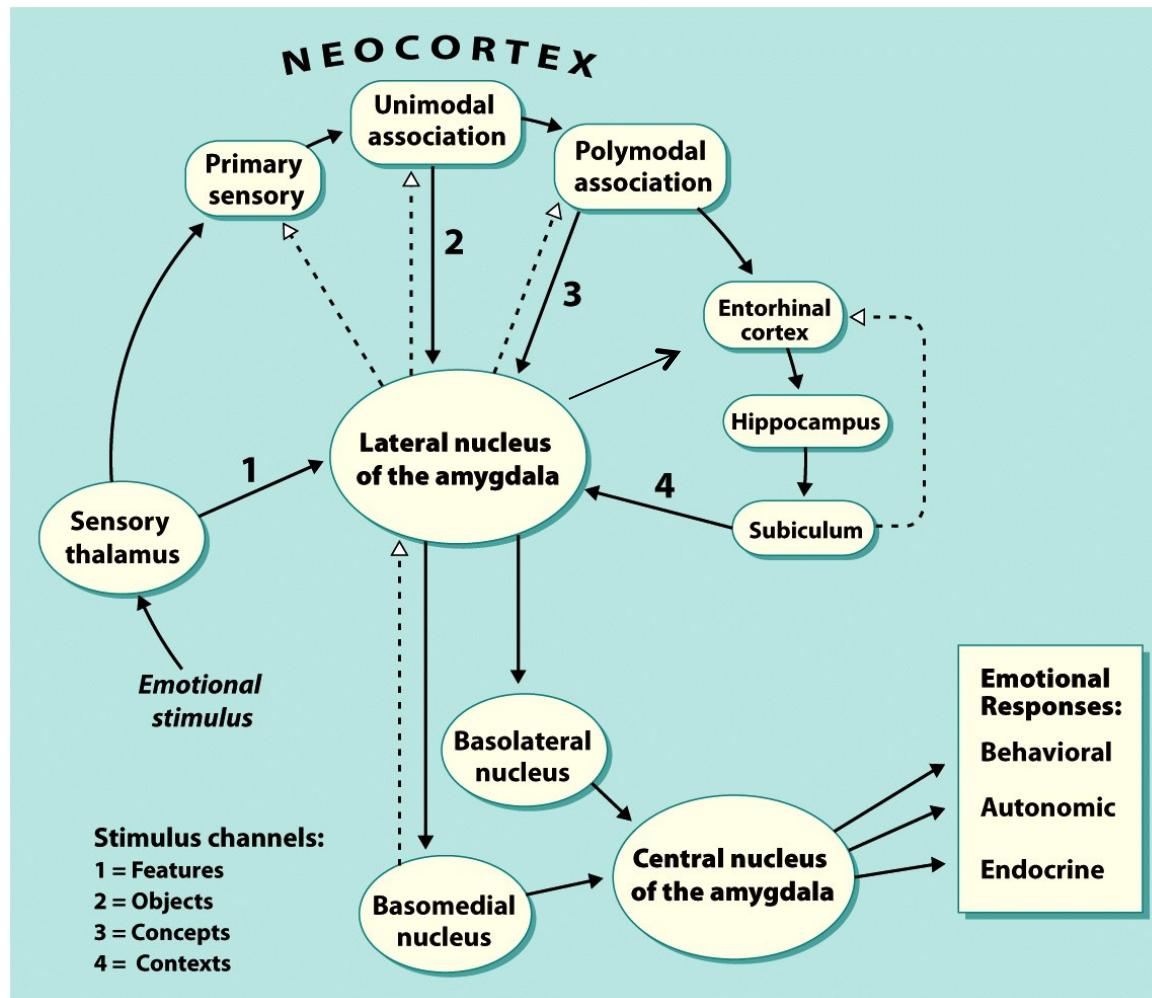


Happiness-Cognition

Mechanisms of fear conditioning

Fear and learning:

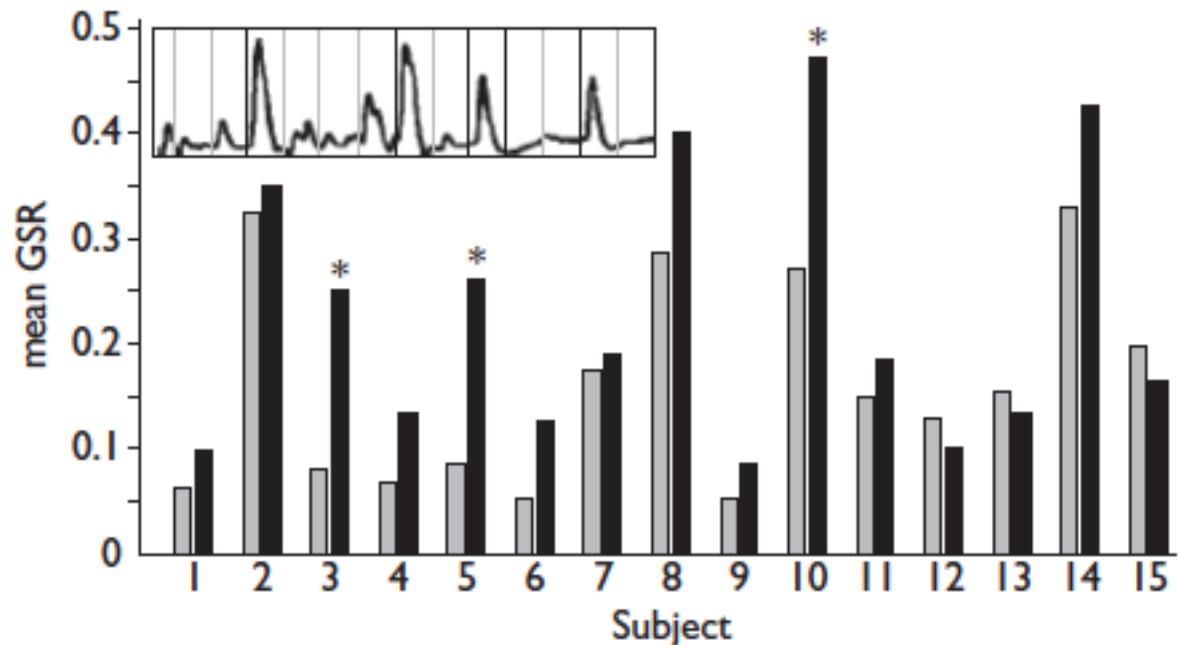
Information from many brain areas converge on lateral nucleus (which also outputs to same areas, including memory systems) → initiate emotional response in multiple systems



Does She/He REALLY Love Me?

- What if she/he lies?
- Use some physiological measures, like Galvanic skin responses (GSR)?
 - Sensitive to emotion & arousal
 - used in polygraph

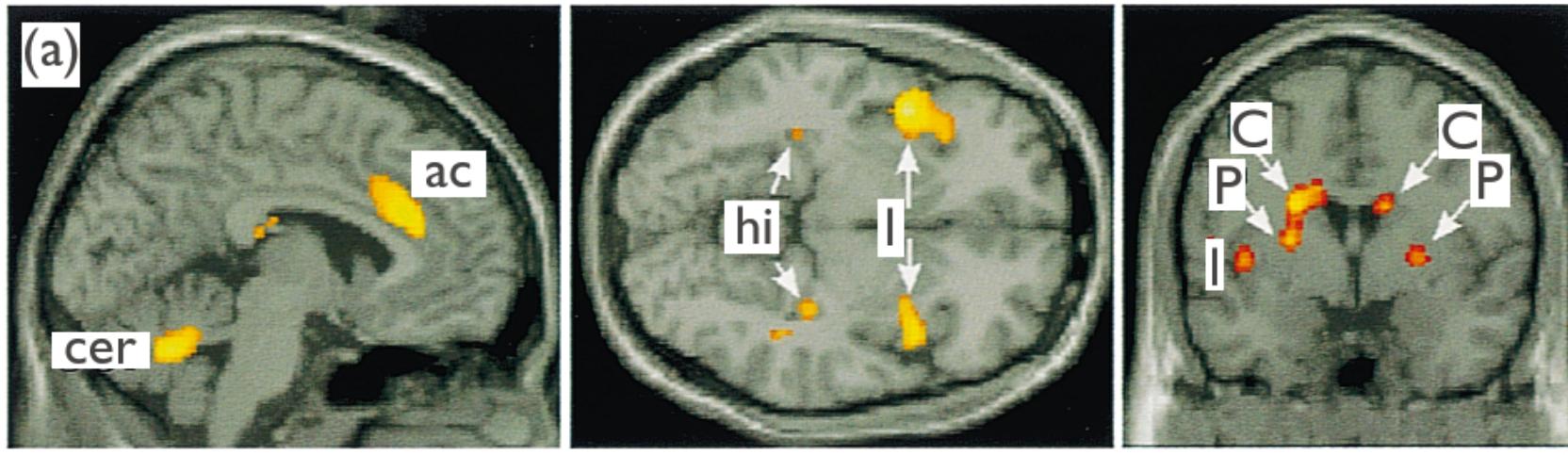
15 subjects viewed pictures of their loved partner (in black) and those of their friends (in gray).



Only 3 out of 15 success rate

Bartels and Zeki, Neuroreport, 2000.

“In love? Congratulations, you just lit up your Love Network”



ac=anterior cingulate

Cer=cerebellum

hi=hippocampus

I=insula

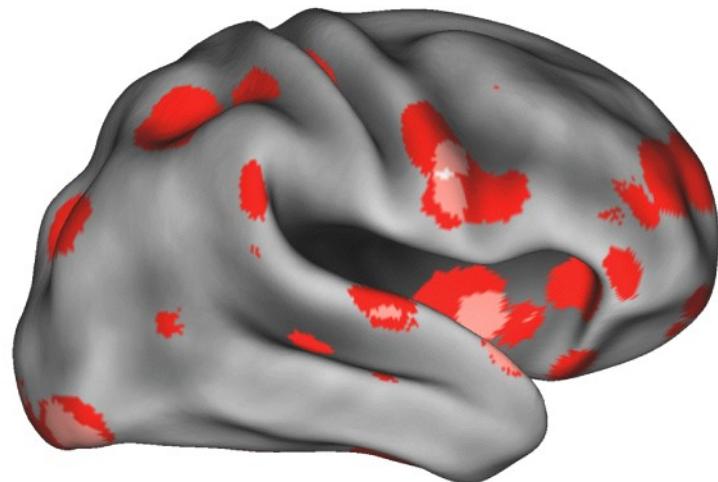
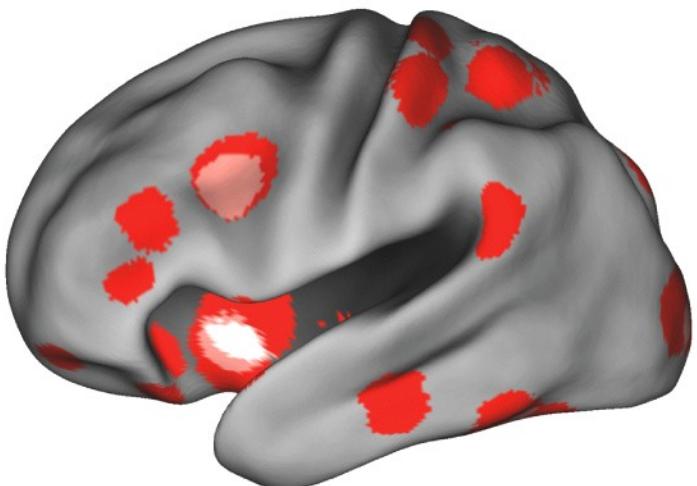
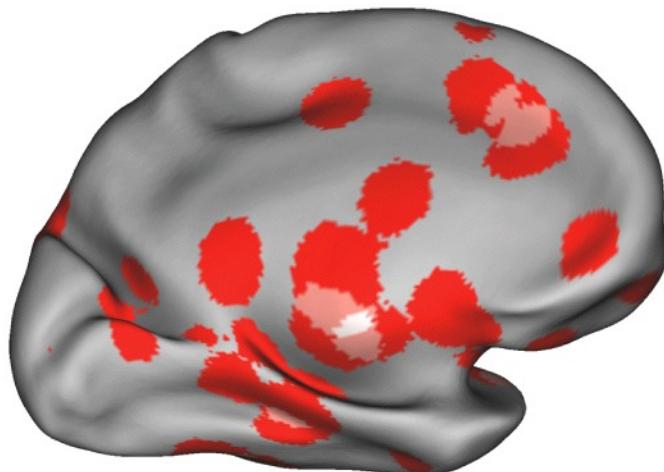
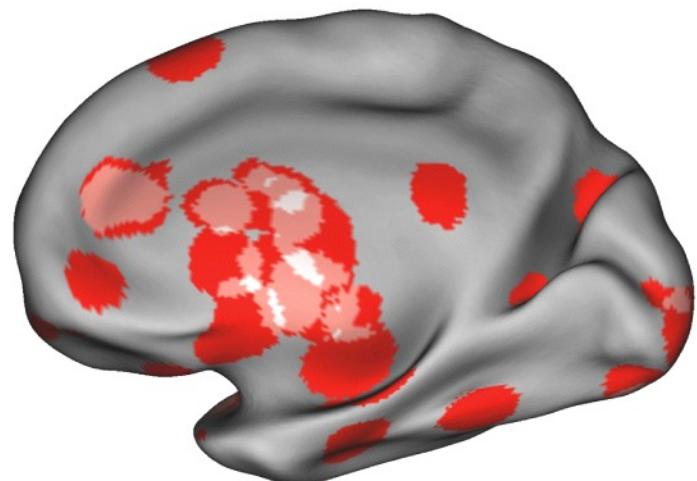
C=caudate nucleus

P=putamen

Compared: pictures of lover vs. pictures of friends

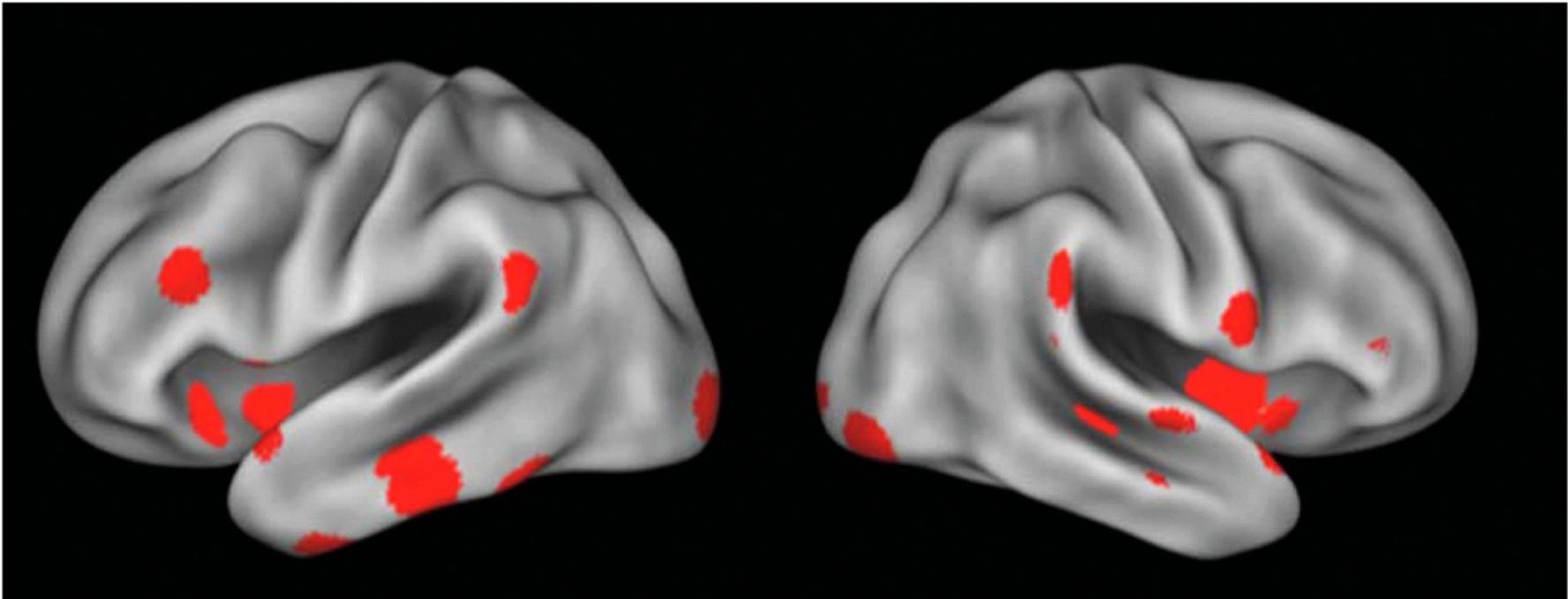
Bartels and Zeki, Neuroreport, 2000.

Love activations encompass multiple brain regions



Ortigue et al. (2010a). Neuroimaging of Love: fMRI Meta-analysis Evidence toward New Perspectives in Sexual Medicine.
Journal of Sexual Medicine, 7(11): 3541–3552. © 2010 International Society for Sexual Medicine.

Passionate love network



Ortigue et al. (2010a). Neuroimaging of Love: fMRI Meta-analysis Evidence toward New Perspectives in Sexual Medicine. *Journal of Sexual Medicine*, 7(11): 3541–3552. © 2010 International Society for Sexual Medicine.

To understand

- Is emotion an entirely subjective experience?
 - No
- Is internal emotional experience subject to scientific inquiry?
 - Yes
- What is emotion?
 - Interaction of many brain regions

Essentials

- Emotion
 - Basic emotions: Ekman's universal facial expressions
 - Emotion dimensions
- Amygdala & fear:
 - Patient S.M.
 - One account: facial processing
- Insula & disgust